AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 18, NO. 43. WEEKLY. | NEW YORK, THURSDAY, OCTOBER 24, 1895. | $3.00 per Annum. SINGLE COPIES 6 CENTS.

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Straight-Line Engine Direct Connected to General Electric Company's Dynamo.

The plant shown herewith is in line with present practice for electric light plants for office buildings, apartment houses, etc., and for isolated plants it makes a compact, quiet running, and in general a very desirable arrangement.

The design of the base is different from others, and the arrangement of coupling differs from the most common practice, *i. e.*, that of having the armature forced on to an extension of the engine shaft.

In this combination the engine and dynamo shafts are separate, and coupled together by a friction coupling, which can be so set that in case the dynamo is short-circuited, the coupling can slip and prevent a burn-out.

This arrangement presents these advantages: the engine and dynamo can be completed separately at the works, and combined at the place of installation; can be more easily handled separately than combined, and either can be dismounted without interfering with the other.

Fig. 2 gives a section of coupling. One-half is a flange forged on the dynamo shaft, and the cone placed on the pulley seat of the engine shaft has a key to prevent it from turning, a pin to prevent working off endwise, and it is split so that the tighter the conical shell is drawn on, the tighter the cone grips the shaft. The whole when tightened makes as rigid a job as a solid shaft, with the slip feature added.

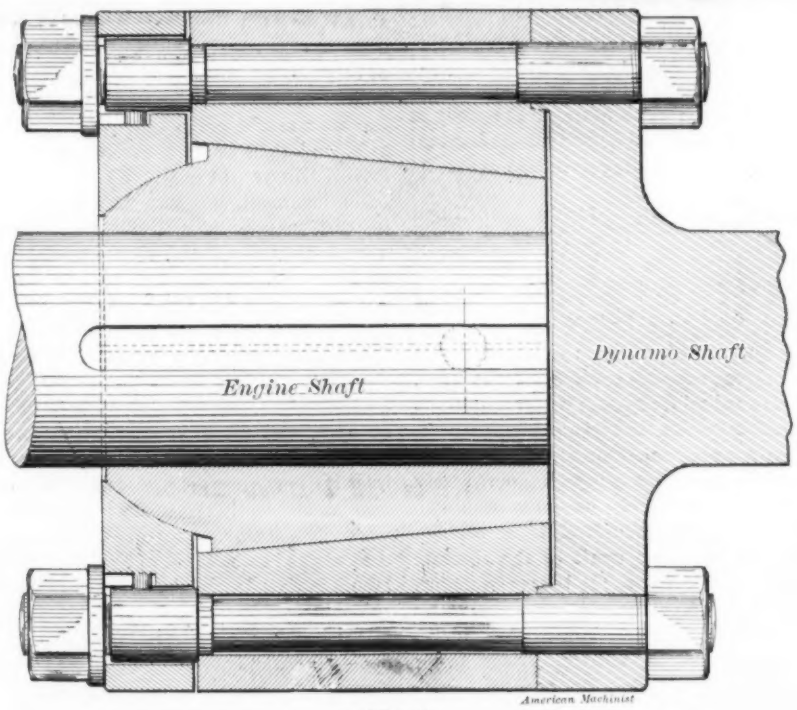
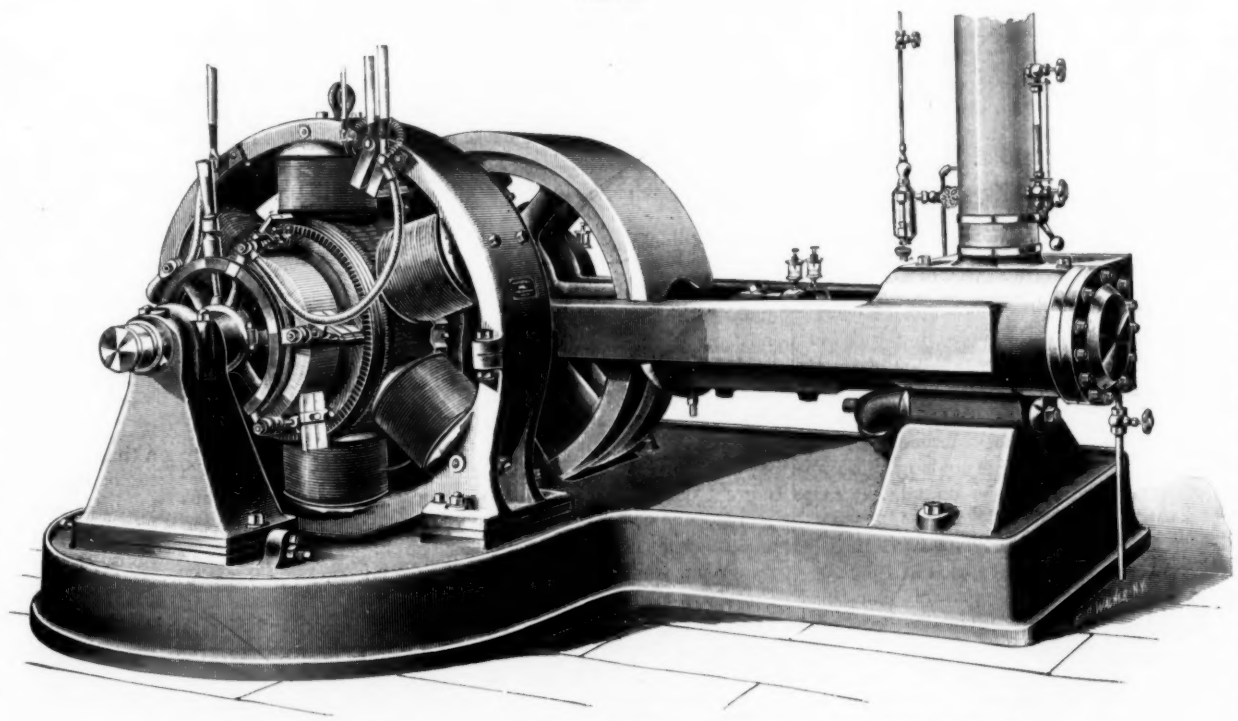


Fig. 2.

Of the engine little need be said, as it has formed the subject of illustration and description in our columns previously.

The generator is for a lighting current, and is what the builders call their Iron-clad, 25 K-W., which means that the winding is put into slots cut across the face of the armature so that the winding cannot be injured by accidental contact with the poles. There are six poles, and the frame of the machine is made entirely of steel. The bearings have spherical seats outside, so that they adjust themselves to alignment, and they are self-oiling. The speed is 305 revolutions per minute.

Two of the machines, as shown, are running at the House of Relief, Hudson and Jay streets, New York City, and their neatness and elegant running are remarkable.



DIRECT CONNECTED STRAIGHT-LINE ENGINE AND GENERAL ELECTRIC DYNAMO.

By action taken at a joint meeting of coal miners and operators of the Pittsburg district on the 11th inst., it was decided to do away with all "company stores" after January 1st. A differential rate of five cents a ton in favor of operators who did not have stores went into effect October 1st.

Units of Force and of Mass.

BY G. A. GOODENOUGH.

So many articles have appeared in the AMERICAN MACHINIST recently concerning force, mass, weight, etc., that it seems almost superfluous to add another to the list. However, the subject is not yet exhausted. There are several points which may be yet discussed with profit; and some of the readers of the MACHINIST who may be mentally struggling with the relations between these fundamental units, may possibly have their mental vision made clearer by reading a presentation of the subject from a somewhat different standpoint.

The article by Mr. Clark (AMERICAN MACHINIST, July 11th) is a perfectly logical and consistent presentation of the elementary principles of mechanics. He arrives at the fundamental equation $F = m\,a$, and shows how the equation may be used in the solution of actual problems. But in order to define the units of force and mass, he is obliged to introduce the totally foreign ideas of weight and gravitation. The units so defined constitute what is known as the *gravitation system* of units. The system is an artificial one, but is the one, unfortunately, which is chiefly used by most American writers on mechanics. Its advocates claim that it is more convenient than any other, but so far as appearances go, the chief result of using the system is the almost hopeless confusion of ideas which certainly exists, and which necessitates these discussions and explanations which appear in the technical journals. In problems of mechanics involving the idea of motion, we have four things to consider—force, mass, distance and time. For example, a body moves on a frictionless horizontal plane, under the action of a force; or the problem may be this—a body moves in a circle of given radius with a known velocity, under the action of centrifugal force. In either case we seek a knowledge of, first, the mass of the body; second, the force acting on the body; third, the distance moved over by the body; fourth, the time occupied. It will be seen that we care nothing for the action of gravity in the solution of such problems. Weight is not a property of matter, it has no particular connection with forces, except the force of gravity, and it can have no definite relation to distance or time. Hence our four elements, force, mass, distance and time, are, or should be, independent of the idea of weight, and we should be able to define the units of force, mass, etc., without introducing either the idea of weight or the idea of gravitation.

Mass is defined as quantity of matter, therefore the unit of mass is a body containing a unit quantity of matter. This unit of mass has been arbitrarily fixed; it is the oft-mentioned piece of platinum owned by the British Government. The quantity of matter contained in this piece of platinum is the fixed invariable unit of mass. We have here a unit which is independent of weight, gravitation and locality.

The unit of distance or length is the foot. Like the unit of mass, this is arbitrary. The British Government simply decreed that a certain definite length should constitute a unit. This length is the standard yard, but by common consent the foot is used as the unit in physical and engineering calculations. The unit of time is, of course, the second.

The units of mass, length and time as above defined are called the *fundamental units*. They are arbitrarily fixed and are perfectly independent of each other. All the other units used in mechanics are dependent upon some or all of these fundamental units. Thus the unit of velocity is the foot per second, and is therefore derived from the units of length and time; the unit of acceleration is an increase of velocity of one unit per second. Therefore the unit of acceleration is derived from the units of length and time. Units thus derived from these fundamental units are called *derived units*.

The unit of force is *not* a fundamental unit. It cannot be fixed arbitrarily, but must be derived from some relation existing between force, mass, distance and time. This relation is furnished by direct experiment. Suppose a mass of one pound (it is immaterial whether the weight of this mass

is one pound or one ounce) placed upon a frictionless horizontal plane. A certain force is applied to this mass, and causes it to move from a state of rest. As long as the force is applied to the mass it (the mass) will continue to move with an increasing velocity. If, for example, the velocity of the body at the end of the first second is 3 feet per second, it will be 6 feet per second at the end of the second second, 9 feet per second at the end of the third second, and so on. That is, the given force has produced an acceleration of three units per second in the given mass. Suppose now double the force acts upon the pound mass, it is found by experiment that the velocity of the mass will increase each second 6 feet per second, that is, the acceleration is six units per second, instead of three.

If now we double the mass we find that it is necessary to double the force also in order to produce the same acceleration. Consequently we are led to the conclusion that the force acting upon a mass is proportional both to the mass and to the acceleration produced. The unit of force is now defined as *the force which, acting upon a unit mass (the pound), produces unit acceleration.* Two units of force would produce two units of acceleration in a unit of mass, or one unit of acceleration in two units of mass. Six units of force would accelerate the velocity of a 2-pound mass 3 feet per second each second.

This relation may be expressed algebraically by the equation

$$F = m\,a, \qquad (1)$$

F representing the number of units of force, m the units of mass, and a the units of acceleration.

As we have seen, the unit of acceleration involves the units of length and of time. Hence the unit of force, as we have defined it, involves all three of the fundamental units—pound, foot, second.

The unit of force defined in the above manner is the *absolute* unit of force, and is called the *poundal.* The system of units is called the *absolute* system, for the reason that they are all independent of locality. The poundal and the pound mass are the same at London and New York, at the Equator and the North Pole.

One or two problems will best show the application of the absolute system to practical problems.

Example 1. What force acting upon a mass of 30 pounds will give it a velocity of 4 feet per second at the end of the first second, 8 feet per second at the end of the second second, and so on?

The increase of velocity is 4 feet per second in one second; that is, four units of acceleration are produced each second. Then,

$$\text{Force} = \text{mass} \times \text{acceleration} = 30 \times 4 = 120 \text{ poundals.}$$

Example 2. A mass of 50 pounds moves in a circle 24 feet in radius with a velocity of 9 feet per second. What is the centrifugal force?

The formula for centrifugal force is,

$$\text{Cent. force} = \frac{\text{mass} \times \text{velocity squared}}{\text{radius}}.$$

In the present case,

$$\text{Cent. force} = \frac{50 \times 9^2}{24} = 168\tfrac{3}{4} \text{ poundals.}$$

In each case, the fundamental units of mass, length and time were taken as pounds, feet and seconds, respectively. Hence the resulting force must be in poundals.

In the absolute system the unit of work or energy is naturally the *foot-poundal.*

Example 3. A mass of 600 pounds moves at a velocity of 20 feet per second. What is the kinetic energy of the body?

We have,

$$\text{Kinetic energy} = \frac{\text{mass} \times \text{square of velocity}}{2}$$

$$= \frac{600 \times 20^2}{2} = 120{,}000 \text{ foot-poundals.}$$

So far it has not been necessary to introduce the ideas of weight or gravitation. If it is desired, it is very easy, however, to find the relation which the absolute unit, the poundal, bears to the gravitation unit, the lb. (I shall denote the pound when used as a unit of force by the abbreviation lb., and reserve the word pound for the unit of mass, which is its true significance). As shown by Mr. Clark, the lb. (force) acting upon the pound (mass) produces an acceleration of 9 feet per second each second. The poundal (force) acting upon the pound (mass) produces an acceleration of 1 foot per second each second. Therefore the lb. is 9 times the poundal, or

$$\left.\begin{array}{l} 1 \text{ lb.} = 9 \text{ poundals} \\ 1 \text{ foot-lb.} = 9 \text{ foot-poundals} \end{array}\right\} \qquad (2)$$

It is to be carefully observed that the lb. is the gravitation unit of force, and is not to be confused with the pound mass. The lb. is no more identical with the pound of mass than it is with the pound sterling.

Equations (2) furnish the means of passing from one system to the other. For example, in Example 2, the centrifugal force was found to be 168¾ poundals. If the force is required to be in lbs., simply divide 168¾ by 9 or 32.2.

Force in lbs. $= 168\tfrac{3}{4} \div 32.2 = 5.24$ lbs.

In Example 3, the work expressed in foot-lbs. is

Work $= 120{,}000 \div 32.2 = 3{,}726.7$ foot-lbs.

We, of course, arrive at the same result, whichever system we apply. Thus, if gravitation units are used, Example 2 would be solved thus: The mass of the body is 50 pounds; therefore its weight (at London) is 50 pounds, and in gravitation units its mass is $\frac{50}{9} = \frac{50}{32.2}$. Hence centrifugal

$$\text{force} = \frac{m\,v^2}{r} = \frac{\frac{50}{32.2} \times 9^2}{24} = 5.24 \text{ lbs.}$$

The question now arises: Since the same result is reached whichever system is used, why is the absolute system preferable to the gravitation system, or *vice versa?*

From a purely scientific aspect, the absolute system is, of course, preferable merely because it is absolute. Its units are independent of weight, gravitation and locality. Practically the chief merit of the absolute system is its clearness. It is easy to understand; the student quickly sees that if he takes pounds, feet and seconds for units, any operations upon these units must bring out force in poundals, or work in foot-poundals. Again, the pound is the unit of mass used in the ordinary every-day operations of business. When we see a mass of coal, we think of it as being a certain number of *pounds.* The gravitation unit which has no name, but which is something over 32 pounds, is never seriously taken as the unit of mass, except in the solution of problems in mechanics. On the other hand, it may be urged against the absolute system of units that the poundal is not the ordinary everyday unit of force. We are accustomed to speak of a force 10 lbs., and it would be inconvenient to use 322 poundals instead. This is true, but there is an advantage also in using the poundal. By giving the unit of force and the unit of mass different names, we arrive at a clear cut conception of the difference between mass and force. There is no danger of confusing the poundal with the pound, but there is great danger of confusing the lb. with the pound.

In conclusion, I have seen both systems actually tried in the college class room, and it is doubtful if one student out of ten ever really understands the elementary principles of mechanics, if he falls a victim to the gravitation system. He learns from experience that he must multiply or divide by 9 in order to obtain correct results. Why he uses the factor 9 is a mystery to him, and a mystery which is not readily cleared up. Sometimes the 9 appears on the wrong side of the equation, and leads to absurd results. Thus a writer in one of the leading technical journals, after defining the pound as the unit of force, proposes the following problem: "If a force moves a 20-pound weight at the rate of 40 feet per second, how much is that force?"

The answer obtained is 25,600 units of force (presumably lbs.) This astounding result was probably obtained by multiplying by 9 where he should have divided. If we take 40 as the acceleration, the force is

$$F = m\,a = 20 \times 40 = 800 \text{ poundals} = \frac{800}{32.2} = 24.8 \text{ lbs.}$$

The author of the above problem is now a professor in a technical college. He was evidently taught the gravitation system of units.

On the other hand, students rarely experience any difficulty in understanding the absolute system. The annoying 9 does not enter into the equations at all unless it is desired to reduce poundals to lbs., or *vice versa*, and in this event we fully understand why it is used, and what to do with it.

Philadelphia, Pa.

Boiler Makers as Boiler Inspectors.

A discussion has been in progress for some time past in the columns of *The Engineer*, London, upon the above topic, and a leading editorial in a recent issue offers some remarks in the way of summing up the results of the discussion. The boiler maker is represented as being little, if any, better qualified for efficient inspection than any other man may be. Attention is first called to the responsibilities and the powers of inspectors. An inspector may condemn a boiler, and order its disuse, inconveniencing the user much, or he may pass a boiler as safe, and then it may explode with great loss of life or property. If the user of a boiler insures it, and does not follow all the instructions literally, and an explosion occurs, then the Board of Trade will jump on him; and it will jump on him also for not insuring, if an explosion occurs in that case, so the inspector should be able to handle the boiler user with tact and judge the boiler with reliable skill, saying unhesitatingly when a boiler must be laid up at once, and when another boiler may be run for a month or six weeks, or longer, as the case may warrant. It is easier to ask than to answer in these days the question, what is a boiler maker? Is it everybody that works in a boiler shop? Subdivision of labor has transformed the boiler-making trade more than most of the old trades. Riveters know nothing of boilers as boilers. Some operate hydraulic riveters all the year round. Then others have no occupation in life but calking. Then there are tube setters, or those who put on furnace fronts, or fit uptakes, or work a flanging press, or weld flues, or manage heating furnaces, and the old-fashioned, all-around boiler maker is practically extinct. Only some of the older foremen boiler makers or shop proprietors could to-day personally execute all the operations and manipulations involved in the construction of a boiler, and they could not be induced to act as inspectors. As things stand, why is not an engineer as likely as a boiler maker to make an efficient inspector? Take the trick of sounding plates for thickness. Not a boiler maker in fifty can tell whether a plate is thick or thin, the boiler being on its seating. By hammering he may tell whether the plate is thickly coated with rust or not, because the rust will drop off under the jar, and if the plate is very thin the hammer may go through, but it is absurd to tell of determining by the hammer whether the thickness of a plate is ⅜ inch or ½ inch, and no one would credit such evidence. Whatever value there may be in sounding with a hammer the art of it may be acquired by anyone with a little practice. Any defect that will really endanger a boiler is either easily detected or so concealed that it is next to impossible to detect it at all. Take an ordinary Lancashire boiler on two carrying walls. The side flues may be examined inch by inch by a lamp, and the plates may be sounded all over in the flues, not so much to tell the thickness of the plate as of the rust upon it, and the same with the bottom flue; but nothing can be told about the condition of the plates, where they rest on the carrying walls—one of the most likely places for corrosion to occur. These spots can only be inspected by pulling the walls down, and then it does not require a boiler maker to tell the extent of the corrosion. If access to the transverse seams inside can be had it may be found that a plate is more or less deeply notched by corrosion, but a knowledge of the art of riveting boiler seams is of little help in detecting it. Every mechanical engineer who has had a reasonable training has considerable practical knowledge of boiler making and boiler using, and it is as much a part of his business to know whether a boiler is well made or not, as to know the soundness of a casting, or whether a piston rod is straight and round. If a patch is put on a boiler, it is not for the inspector to say, in formal words, that the patch is properly put on or not, but the patch being on, whether the boiler is safe to work at a given pressure. *The Engineer* claims that in the discussion referred to no proof has been produced that a boiler maker inspector will detect defects that escape the engineer inspector. A practical boiler maker once passed a large pair of boilers for 40 pounds pressure, the writer of the article pronounced them unsafe at 30 pounds, and the engineer of an insurance company said that he would accept them for twelve months at 20 pounds. Similar cases might be sighted where engineers have passed unsafe boilers as safe. The work can only, after all, be properly done by men specially trained to the work of inspection. Almost anyone can inspect new boilers. The difficulty begins when the inspector has to do with boilers that are more or less rickety. A large patch of corrosion is found on a plate. The corrosion is cleaned off, and the plate cemented in the best manner. Is the boiler safe for another year? It is if the corrosion does not extend. Will it extend? These questions the inspector meets daily, and boiler-shop experience will not solve them. The boiler maker may know that seam rips are to be expected in particular types of boilers, because he has frequently repaired them. But the engineer should know that seam rips occur in such boilers, just as well as the boiler maker knows it.

This subject might have been made still more difficult of satisfactory solution, if reference had been made to the various types of water-tube boiler, now so common, many of which have never seen a boiler shop or a boiler maker, and are the product of the machine shop almost as completely as the steam engine itself is.

Safe Burglary.

Soon after the publication of our illustrated article showing how a screw door safe was opened by aid of nitro-glycerine, at Pullman, Ill., we learned that it was being charged that our article was not worthy of credence, as it was only a one-sided statement paid for by a rival safe maker. We therefore invited the company who made the wrecked safe to assist us in procuring facts bearing upon the other side of the question, and not only offered to publish such facts without payment, but offered to go to any reasonable expense in the publication of such an article. After waiting for a time and receiving no answer, we reminded the company of our unanswered letter, and then received a letter declining to take up the matter. We therefore conclude that there is little or nothing that can be said against the accuracy or fairness of the article.

Bicycle Tools—IV.

WOOD RIM MAKING—CONTINUED.

Continuing the description of wood rim making as carried on at the establishment of The Indiana Novelty Mfg. Co.

The rim goes, after marking, to the joint cutting machine, Fig. 17. This is a very simple, ingenious and effective tool, designed by Mr. Marble; the method is to support the rim in a fixture *A*, to which the rim is clamped by the shoe *S*, hand wheel *B*, and screw operating in the nut *C* to raise or lower the shoe *S*, the rim being so placed that the length mark made by the measurer stands flush with the right-hand face of the gage block *M*. The fixture *A* is carried in

a vertical plane of motion on the slide *G*, confined in the way *H*, and jointed at *I* to the horizontal wooden hand lever *L*, so that the fixture carrying the rim can be moved either up or down at the will of the workman. When first placed in the machine with the rim so placed the method is to move the rim carrying slide *G*, first down to cut the end off at the mark, and then lift on the lever *L*, move the slide carried rim up to and past the gang of joint cutters, cutting the V-teeth of the joint as it goes. jointed the fixture clamp is released, and the other end of the rim is cut in precisely the same manner with the same tools. This method finishes each end at one setting, and is extremely accurate and expeditious in operation.

pot, the best glue, of course, being used, then the rim is put inside the open squeezing ring, which is rapidly closed by the hand screws, a man and a boy making the gluing gang. The joint is driven fair with a hammer. The joint after being tightly

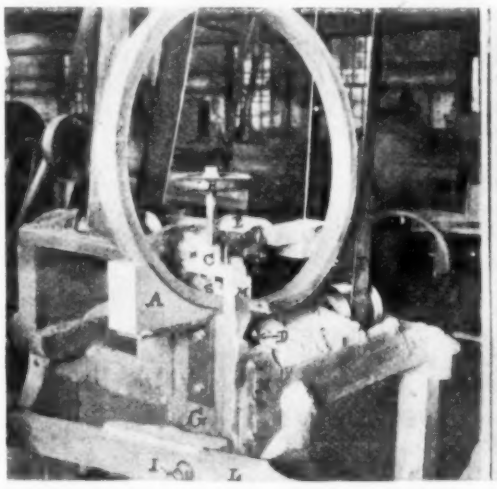


Fig. 17.

Fig. 18.

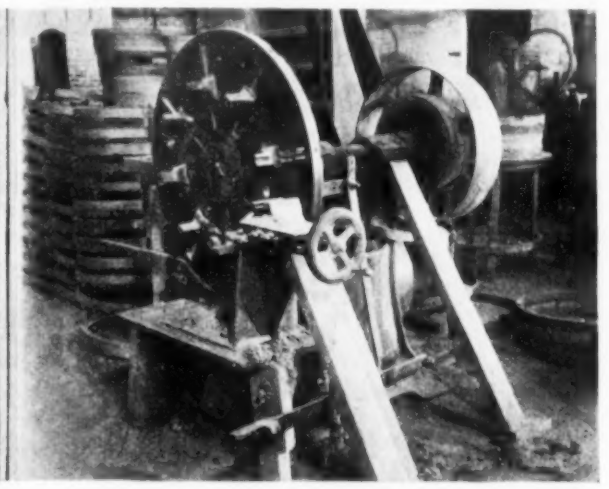


Fig. 19.

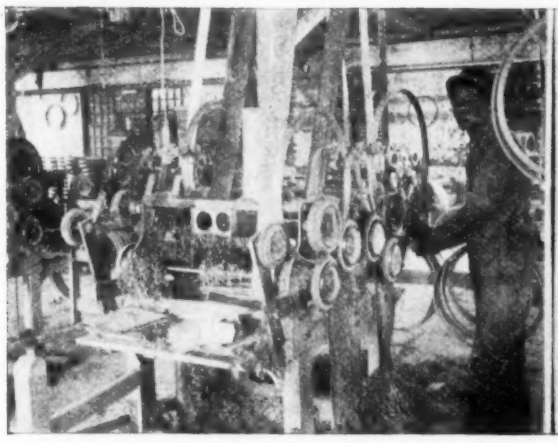


Fig. 20.

Fig. 22.

Fig. 23.

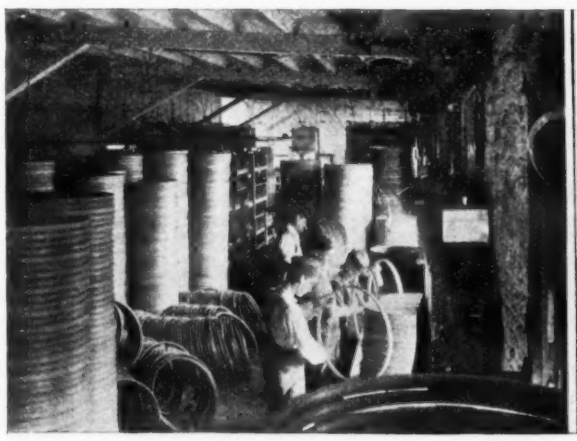


Fig. 24.

Fig. 25.

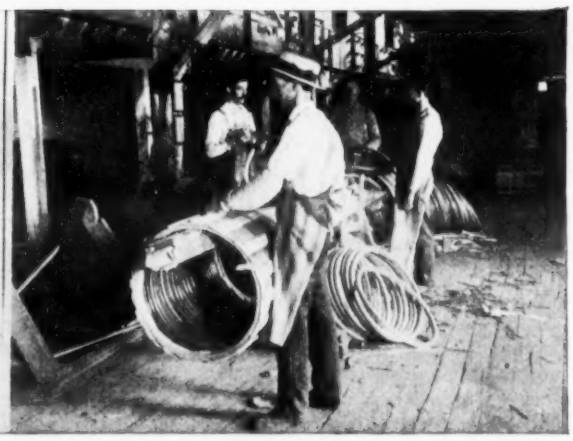


Fig. 26.

Fig. 28.

Fig. 30.

Fig. 31.

MAKING WOOD RIMS FOR BICYCLES.

the rim end to be operated upon stands about midway between the cutting-off saw *D*, driven from the overhead countershaft, not shown, by the quarter-twist belt *F*, and the overhead gang of joint cutters seen immediately under the curved guard *F*. The cut-off saw spindle stands at right angles to the joint cutter spindle, but both are driven from the same overhead countershaft, the joint gang with a straight belt, and the cut-off saw with a quarter twist, as previously stated. As soon as one end is

After jointing the rim goes to the gluing bench, provided with an iron wheel-squeezing band fastened at each end to screw actuated blocks, all as very clearly shown in Fig. 18. The two jointed ends of the rims are dipped successively into the glue closed is secured with a small iron screw clamp, such as are shown in the engraving, the screws are turned back, and the rim is piled to dry as is shown in the background.

After drying the rim is ready for the turning lathe, Fig. 19. This is a face lathe

with an overhung driving pulley, friction connected to the spindle, an adjustable universal 8-jawed chuck, having each jaw mounted on an independent adjusting screw, all of the lower ends of the screws being collared to radially sliding blocks actuated by inclined slots in a cam plate actuated by a toggle joint. The toggle joint has one member prolonged in a hand lever, by a single movement of which all of the chuck jaws are opened or closed. The tool slide is hand-screw driven in ways on top of a pedestal standing on a shelf cast on the front side of the main upright of the frame. The frame is webbed in three planes, and requires the wood bracing to the floor, shown in the engraving. A full box-frame design for these lathes is now in hand. The foot treadle in front operates the friction clutch, and a hand lever in the rear operates a face-plate brake. The same lathe is used for both inside and outside cuts. Rims requiring a dovetail cut to hold the tire (like the Gormully & Jeffery) get it on a second special machine, after the first open cut is made on the outside of the wheel rim. Any such cut could be easily made at a second operation on the lathes, shown in Fig. 19. The scraping and sanding machines are shown in Fig. 20. These are arranged to accommodate four workmen each, and the framework of each machine is consequently arranged to support four distinct and wholly independent sets of rim-driving rolls, each set consisting of two fixed and one movable, rubber faced, outer rim-carrying wheels, and one internal, treadle-actuated wheel of the same character, making four wheels controlling each rim; and of these four the two outer wheels nearest the inner wheel only are driven by the overhead belts. These driven wheels are mounted on the overhanging ends of four shafts, two at each end of the machines, which cross the framing, and have their driving pulleys between the journals; one rather wide belt being carried around the pulleys of the same system. This makes a very steady and reliable drive for the rims, which are first scraped with steel scrapers, and then sandpapered to a fine finish.

The finished rim now passes to the first inspectors, who carefully examine each rim, and make good any minor defects in the way of roughness or small splinterings or minute failures in gluing, and also condemn any rims which show serious defects of any sort.

From the first inspection the rims go to the finishing room where they are first dipped in the filler vat, shown in Fig. 22, and then placed on the rack at the right to drip, the inclined table underneath the rack carrying the drippings back to the vat.

From the dripping rack the rims are taken by the wipers, Fig. 23, at an adjacent table where they are rubbed with a wad of "excelsior" or fine wood fiber, until the filling closes all open pores of the wood.

The rims are then passed on to the final inspectors, Fig. 24, who grade the product into first and second quality, the second quality being such rims as have a less beautiful appearance owing to the grain and color of the wood. No rim with any apparent defect is passed to sale. The final inspectors put the company and grade stamps on the rims in black, and pass them on to the varnishers, shown in Fig. 25. The successive coats of varnish, all of one quality (the most durable as proved by use and experiment), are applied by hand with a brush, and the varnished rims are placed in specially devised movable racks, clearly shown in Fig. 25, to dry. These racks are open at the top, and have separating pins in the side and bottom strips to both separate the rims and hold them perfectly upright to avoid warping while drying.

The rims are next crated, Fig. 26, by the use of rough end rings, to which are nailed longitudinal outer strips of wood over the paper covering surrounding the main body of the crate of rims, each end rim next to the rough crate head ring being separately wrapped all over with paper and the longitudinal outer strips are secured with twine bands, and thus made ready for delivery.

The rim lathes, sanders, jointers, and gluing benches are all located on the main floor, shown in Fig. 28. There is at present so much wood dust on this floor as to make a photograph impossible during working hours The view given was taken at noon, when both machinery and men were idle.

The Novelty Co. also make shaped and bent wood mud guards and chain guards. The mud guards are shaped out of the solid wood for their cross-section. The chain guard is bent after shaping. The wheel guard is bent to its proper curve before shaping. Fig. 30 is a view of the mud guard, sanding and shaping machines in the north wing.

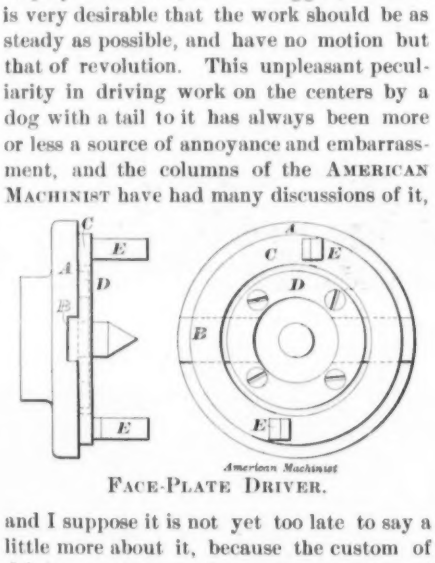
The Novelty Co. has a small well appointed tool shop, shown in Fig. 31, which carries its own explanation to machinists.

Hugh Dolnar.

How Long Shall the Tail Continue to Wag the Dog?

By Frank Richards.

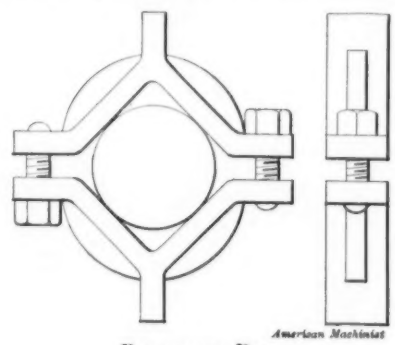
This is an important question, and in the machine shop a perfectly legitimate one, because there the dogs are unfortunately too often in a position to be wagged by the tail. As far as the dog is concerned, this might not make so much difference, but it happens that when the dog is wagged, the work to which it is attached, and which it is employed to drive, is also wagged, when it is very desirable that the work should be as steady as possible, and have no motion but that of revolution. This unpleasant peculiarity in driving work on the centers by a dog with a tail to it has always been more or less a source of annoyance and embarrassment, and the columns of the American Machinist have had many discussions of it,



Face-Plate Driver.

and I suppose it is not yet too late to say a little more about it, because the custom of driving work upon the centers by means of a dog with a tail projecting into a slot in a face plate is still the commonest way of driving such work. When driving work in this way the point of the live center is a fulcrum, and the tail of the dog is one end of a lever, the other end of which is in the work itself. The tendency of the driving force operating upon the tail of the dog is always to spring the work with reference to the cutting tool, so that it will not be turned perfectly round, and is also quite likely to chatter. The leverage and bad effect is, of course, increased with the length of center projecting from the face plate. To me it is rather surprising that Brown & Sharpe, as I notice in the latest issue of the American Machinist, should be looking for this very dog, presumably for use in their shops. If we recognize the effect of the tail of the dog in tending to spring the work and try to get around it by using a straight-tailed dog and a stud projecting from the face plate for a driver, we then get a side pry upon the live center tending to spring it out of the center, and make the work untrue in that way. If the cutting tool is at the end of the work near the dead center, then the pry of the drive upon the live center will be constantly upon the same side of it, but if the cutting is going on near the live center then the side pry upon the center will be transferred from one side of the center to the other with each revolution. With the tail of the dog in front, and at the same hight as the cutting point and the center, the thrust of the cut will be upward. With the tail of the dog at the back of the lathe, or a half of a revolution further around, the thrust of the cut will still be upward, but it will be upon the other side of the center. With the tail in front the pry upon the center will be less than the whole cutting force, but with the tail at the back of the lathe the pry upon the center will be greater than the cutting force, and thus both the intensity and the direction of the side strain upon the center will be constantly changing with the revolution.

I venture to suggest a way of driving work upon the centers that will get rid of most of the trouble that we have been talking about with the dog, and practically banish its malign influence from the shop. It should be readily understood from the sketch given. The face plate *A* has a groove *B* planed or milled across it. The ring or collar *C* has upon its back two tongues which fit into the groove *B*. These tongues do not extend radially outside the periphery of the ring *C*, but they do project inwardly toward the center, and are faced off, so that when the back of the collar *C* is against the face plate *A* they are flush with the face of the plate *A*, or a trifle below it. The



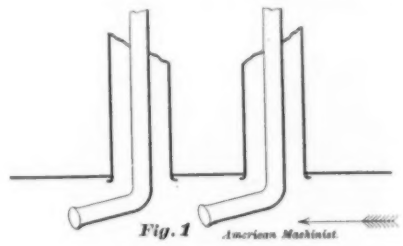
Balanced Dog.

ring *D* is fastened to the face plate by countersunk screws as shown, and covers the inward projections of the tongues of the collar *C*, so that it is held to the face plate, but is free to slide a limited distance. The two driving studs *E* project from the collar *C* somewhat beyond the point of the center, so that they will come in contact with the tails of the dog upon the work to be driven. The driving faces of the studs are placed with reference to radial lines at right angles to the centers of the sliding tongues, so that each of these faces will stand back in opposite directions a distance equal to one-half of the thickness of the tails of the clamp dog upon the work. Any slight inaccuracies in the driving faces of the projecting studs, or in the driven sides of the dog tails, will be compensated for by a sufficient sliding of the ring *C* in the required direction, and the driving pressure upon the opposite tails of the dog will thus always be equalized, and the driving pressure upon the centers will be entirely avoided. The dog shown in the sketch will be readily understood without remark. In screwing it upon the work if the spaces are kept equal the driving tails will be approximately central and the drivers will do the rest. Of course this device will cost something, because it is worth something, and if objection is made to the cost of making it then, of course, the good service that it is designed to render is of little importance to the objector.

Proper and Improper Materials for Steam Engineering Construction.

By Peter H. Bullock.

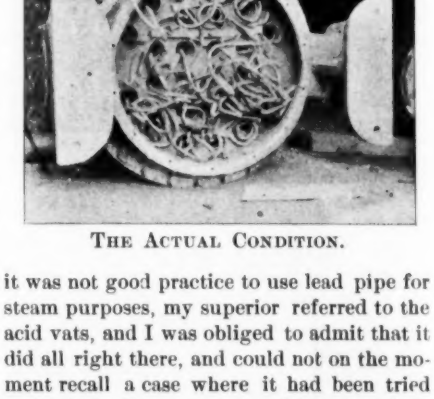
Perhaps there is no other business where so great a variety of materials are used for construction and maintenance as in the various branches of steam engineering. Nearly all known metals, very many kinds of wood, a long list of textile materials, oleaginous products and chemicals are indispensable. Iron and steel stand first, and there are numerous cases where one may not be used in place of the other. The same may be said of copper and its alloys; in fact, all of the most common metals have some special quality that makes them particularly appropriate for some place where that quality is necessary to resist some peculiar force or action of some other material. No one would think of using brass for grate bars, even if it was as cheap as cast-iron, yet brass is an all-important alloy for engineering purposes. Steel or iron will make good piston rods for steam engines, but not for many classes of pumps. I have seen iron pipe in good condition after thirty years use for steam; have also seen it completely



As Designed to Be.

rusted out in ten months by hot water; and so on, through the list of materials, there will be found things that while all right for certain purposes are totally unfit for others where the conditions of use are different.

Some years ago it became necessary to heat certain vats of liquid containing quite a percentage of sulphuric acid, and of course brass or iron pipe would not do. As lead seems to be the only available metal that withstands this acid, pipe coils were made circling several times around the vat and the free end being bent up over the edge. When steam was admitted it heated the liquid all right, and there was no trouble from any source. Now, because this pipe conveyed steam successfully in this case, for special conditions, it does not prove that lead pipe is a proper material to use in other cases for conveying steam. About this time we were in need of a feed-water heater, and I had recommended a well-known make with curved tubes. An agent appeared with, as he said, a new departure in heaters, each tube being single, straight and capped at the top. To induce steam to circulate up the tubes, a lead pipe was put in, as shown in Fig. 1. These pieces had their ends flared tunnel shape and bent in the direction the exhaust went. The action was supposed to be the same as induces draught in a chimney. It was argued that the air would be sucked out of the tubes at once, and that being filled with steam was all that was needed, and that as each tube was independent there could be no straining from unequal expansion. When I protested that



The Actual Condition.

it was not good practice to use lead pipe for steam purposes, my superior referred to the acid vats, and I was obliged to admit that it did all right there, and could not on the moment recall a case where it had been tried and failed. It was purchased in spite of my protest, and never proved to be an effective heater. When in place and connected, the steam space was quite inaccessible, and this part of it was not examined for several years. It had for a long time been growing less effective, and diagrams from the engine showed a back pressure that could not be explained by any theory except by an obstruction in the exhaust pipe. The heater was finally taken out, and when the bottom was removed it was plain to see where the trouble was. Fig. 2 is from a photo as it then appeared. All of the lead pipes had settled down out of the tubes and curled themselves up together in the steam space.

I think most readers will agree that although lead pipe is all right for an acid vat, that it is not the proper thing to use in the construction of a feed-water heater.

A Twenty-two-Ton Radial Drilling Machine.

We present herewith an engraving of a radial drilling machine which was built by C. H. Baush & Sons, of Holyoke, Mass., for the Government; to be set up and used at the Watertown (Mass.) Arsenal.

A good general idea of the size of the machine can be obtained from the engraving, but a few of the leading dimensions will be interesting. The extreme hight of the machine is 17 feet 6 inches, and the bed plate is 14 feet long, 8 feet wide, and 10 inches deep. The greatest distance from spindle to bed plate is 7 feet, and from column to center of spindle 9 feet. The flat face of the column is 2 feet wide, and the saddle has a bearing upon it 5 feet 10 inches long. The width of the flat face on the arm is also 2 feet, and the carriage has a bearing upon it 2 feet 3 inches long. The spindle is 6 inches diameter at its largest portion, and is bored for the Morse taper No. 6.

The spindle has a traverse of 24 inches, and is fed at 160, 135, 95 and 55 revolutions per inch.

The cone pulleys have five steps for a 5-inch belt, the largest step being 24 inches diameter. The back gears are placed directly upon the spindle, and are proportioned for a ratio of 1 to 10¼. There are ten speeds of the spindle ranging from 5 to 285 revolutions per minute, and it can be reversed for withdrawing a tap.

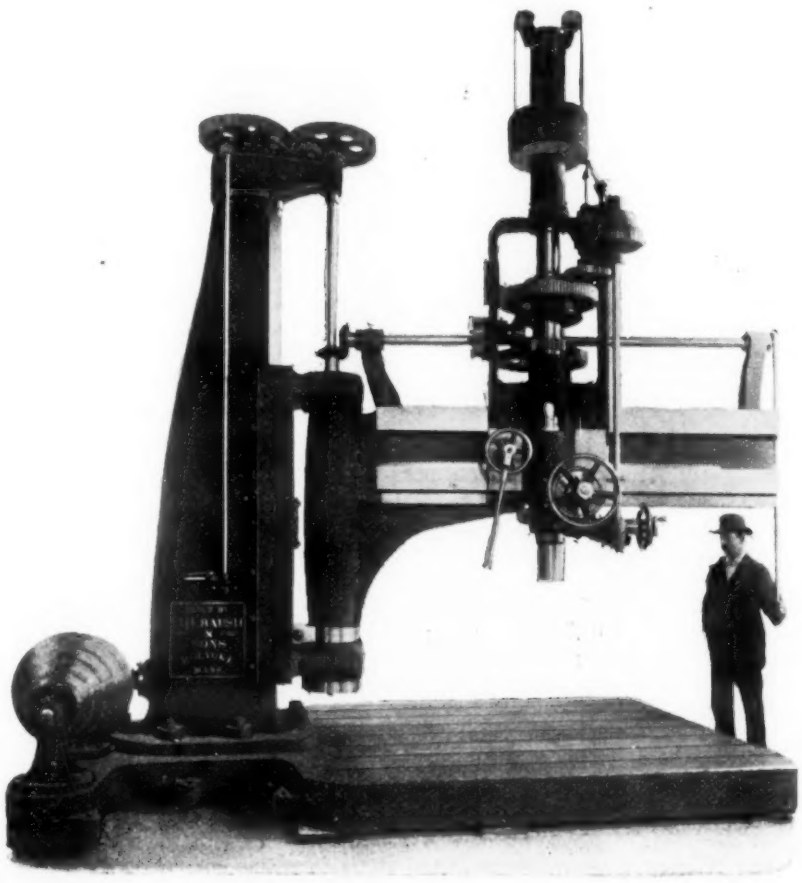
Special attention has been paid to so arranging the pivot bearings of the arm as to enable it to be easily moved by the operator, and for this purpose ball and roller bearings are employed; a careful test with a spring balance showing that the arm and its attachments though weighing over 13,000 pounds can be started in swinging motion by a force of 7½ pounds, and that a force of 6 to 7 pounds was sufficient to keep it in motion. It is found in practice that the operator can readily move the arm by pushing or pulling upon the same hand wheel by which he moves the spindle vertically, even when the saddle is close to the column. At the end of the arm is a rod which slides vertically, and is automatically sustained at any point. By this rod the arm can be swung by a person standing upon the floor, no matter how high the arm may be raised.

Near the lower pivot bearing of the arm is a clamp by which the arm can be firmly fixed in position for boring.

The carriage rests upon anti-friction rollers, is moved by the ratchet lever seen, and can be clamped firmly in position by turning the small hand wheel on pinion shaft.

The small lever on the column, just over the name plate, controls the gearing by which the arm is raised or lowered, and the hoisting screw carries the weight upon steel balls, and is so placed as to be protected from dirt and from accidental injury.

All important bearings are lined with phosphor bronze, and gears are made of steel. The machine is certainly one of the heaviest, if not the heaviest, and largest radial drills ever built in this country.



TWENTY-TWO-TON RADIAL DRILL.

Unmechanical Devices.

BY FRANK RICHARDS.

The interesting series of articles now current in the AMERICAN MACHINIST upon "Bicycle Tools" give us something to think about from the very beginning, and especially as to the value and applicability of some of the mechanical, or, sometimes, the unmechanical, devices employed, and it may not be amiss to say a little on the subject while we have it fresh before us.

It may be proper, in the interest of fair play and a clear understanding, to define as closely as possible the meaning of the terms mechanical and unmechanical, as mechanics have a right to employ them. I should say that the most mechanical device or system is that which, all things considered, is best adapted to the accomplishment of the proposed result. A very common expression of condemnation employed by practical mechanics regarding devices which challenge their judgment is that they are unmechanical, and we usually find that the idea meant to be conveyed is that they are not the best that could have been employed for the purpose. There are mechanics who regard some devices as more mechanical than others independently of the place and mode of their employment. Mechanics generally dearly love toothed gearing, and are slow to condemn its use anywhere as unmechanical; but gears may be out of place sometimes just as much as toggle joints or sprocket wheels and chains may be out of place, and therefore may be unmechanical. The mechanical device is usually the simple device, but it is not always and necessarily true that the simplest is the most mechanical. Simplicity in everything mechanical can scarcely be overrated, but the lasting or slow wearing property may be of first importance in some cases, and this may be sometimes promoted by a little more complexity of device. If it can be shown that serious and constant wear is involved in the employment of a certain mechanism, and that this wear might be mostly avoided by the employment of another device, of the same or but slightly enhanced cost and complexity, then the first must be condemned as the unmechanical one. The terms mechanical or unmechanical can never be employed for sentimental or traditional reasons, but only in view of results accomplished. Nothing, if it will work at all, is unmechanical until a better device can be found to supersede it. Fault-finding has its only justification in its suggestion of something better.

We are not many of us going into the manufacture of bicycles, and we have no interest in the peculiarities of practice in the shops where they are made, except as we can learn from them something that will help us in our own shops, wherever they may be, and it seems to be perfectly proper to criticize and discuss these bicycle tools and methods, just as we would discuss those in other branches of manufacture, and always with a view only to our mutual benefit.

It will be remembered that a certain style of wooden rims for bicycle wheels is made by gluing together several thin flat strips of wood, one inside the other, and all enclosed in a strong cast-iron ring. When the strips of wood are all in place in the ring four iron quadrants are placed inside of them to press them out tightly against the outside ring. Considerable stress, it will be remembered, is laid upon the importance of great pressure to secure perfect joints in the finished rim, and we naturally expect to find that the means provided are capable of applying this great pressure. The quadrants, when the setting out or distending begins, come close together, or nearly so, and the apexes of the four inner angles are cut off so that the inner ends of the quadrants together form a more or less perfect conical opening, and the quadrants are distended or pressed outward against the wooden rims by forcing a conical plug into this opening.

Now the use of a conical plug for distending a number of radiating members is, notwithstanding what I may have said above, an unmechanical, or a mechanically objectionable, device in itself, and regardless of the place of its employment. A conical plug may fit a conical hole perfectly, as in the case of a steady pin or a taper bolt, and if the ends of the quadrant distenders of the wheel rims were rightly shaped they might, say when one-half distended, fit the plug perfectly, but if they did so then they could not possibly fit the plug when the distending commenced, and they could not possibly fit the plug when the distending was completed. When the quadrants were in close to each other, and so that their radiating sides were in contact, if the plug were then entered it would only bear along a line in the center of each quadrant, and when the plug had been forced in as far as it was to go and the quadrants were completely distended the plug would not touch the quadrants in the center at all, but only at both edges of each. It evidently would be impossible to use a plug in an opening of this character, which would be constantly changing its shape, and where the plug would have a bearing upon the quadrant only along a narrow line, or, at the last along two lines, without an enormous amount of friction and cutting, and it is plain enough that the arrangement would be a bad enough one at the best, even with some suitable means of drawing or forcing the plug straight into the opening; but anyone can readily see how much worse this must be, how mechanically atrocious it must be, to expect to force this plug into the opening by working it around in contact with the constantly changing conical surfaces, and screwing it into a stationary nut. It is no wonder that it required two men on a four or five-foot lever to force the plug down. It is morally certain that more than half of the power employed was used to overcome the friction. It would certainly have been much better to have had the ends of the quadrants flat and beveled to a suitable angle, and then to have had a plug that was a frustum of a pyramid, instead of a cone, and to have drawn in this taper square plug by means of a nut working upon a stem on the small end of it.

There are many places in the trade where taper conical plugs are used, generally by driving endwise, for distending members for certain purposes, and the objection applies to all of them that the plug cannot possibly fit the conical surfaces, except at one instant of its longitudinal travel. A tube expander employing this principle has been widely used, and I am saying nothing against it except upon this point. It would certainly have worked better and lasted longer if the inner surfaces of the radial jaws had been flat instead of conical, and if the taper plug had been polygonal instead of circular.

As to the pressure actually produced against the wooden rims by using the taper plug in the manner described, it is to be remembered that the outer surfaces of the quadrants are very much larger than the surfaces in contact with the plug, and that the pressure per unit of surface is therefore proportionately smaller. If the outer diameter of the quadrants when distended is 24 inches, and the mean diameter of the plug is 1½ inches, then a pressure of 1 pound per square inch of the plug against the inner end of the quadrant will mean a pressure of one ounce (avoirdupois) per square inch of the outer surface of the quadrant against the wooden rim. Upon the whole, we may conclude that the arrangement described would give an uncomfortable squeeze to a man's finger if it could take the place of a little section of the wooden rim, but it would not do much more than that.

Franklin L. Pope.

Franklin Leonard Pope, one of the best informed of electrical experts, and of world-wide reputation in his profession, was instantly killed by electric shock in his own house at Great Barrington, Mass., October 14th. He is the first electrician of prominence to meet his death in this manner for years, and the fatal accident in his case seems to be unaccountable, for while the deadliness of the current of high voltage is indisputable, the conditions of safety or of danger in connection with it are clearly defined, and no living man knew them better than Mr. Pope. He was manager of the Great Barrington Electric Light Company, and, for his convenience, a converter or transformer had been placed in the cellar of his house, and he was found dead beside it upon the evening of the date mentioned.

Mr. Pope was born at Great Barrington, Mass., in 1840. At the time of his death he had been living in the town of his birth only about a year, having been for a quarter of a century before a resident of Elizabeth, N. J. He was one of the earliest practicing electrical engineers in this country. In 1863, during the draft riots in New York City, he was employed in the office of the American Telegraph Company and personally rejoined the severed wires connecting New York with Boston. In 1866 he explored parts of British Columbia and Alaska, locating a route for an overland telegraph, which was partly built and afterwards abandoned. He had to do with the perfecting of many inventions, although he was not a great originator of initial inventive ideas. In 1870, in connection with Thomas A. Edison, he invented the one-wire printing telegraph, or stock "ticker." In 1872 he invented the rail-circuit for automatically controlling electric block signals. He became a patent solicitor, and as an expert was engaged in the most important cases, although his plain-spoken honesty made him an undesirable witness in court. For several years he was patent attorney for the Western Union Telegraph Company. In 1885 he was elected President of the American Institute of Electrical Engineers, succeeding the late Dr. Norvin Green, President of Western Union, in that position.

Mr. Pope was one of the ablest writers upon electrical subjects, and his writings have done much for the thorough and correct instruction of the whole generation of electricians. His valuable work on "Modern Prac-

tice of the Electric Telegraph," a standard everywhere, was first published before 1870. He leaves a widow and three children. His brother, Ralph W. Pope, is Secretary of the American Institute of Electrical Engineers; another brother is with the American Telephone and Telegraph Company, of New York City.

Death of a Successful Manufacturer.

Mr. Eugene Langen died on September 2d, at his estate of Elsdorf, near Cologne, Germany, aged about sixty years. His name may not be familiar to our readers, but will possess an interest from the fact that he was one of the directors of the Otto Gas Engine Works, of Philadelphia, and father of the present president of that company. He was also a director of the largest manufactory of gas engines in Germany. Mr. Langen was one of the largest manufacturers of beet sugar in the world, having acquired about $20,000,000 in that business. He had also other extensive business interests, and had received many decorations for his ingenuity and enterprise. He visited this country in 1894. Twelve children survive him.

LETTERS FROM PRACTICAL MEN.

That Double-Spindle Lathe.

Editor American Machinist:

That two-spindle lathe in the American Machinist, October 3d, caught me the first thing. It gives you a shock when you first look at it, and then, when you do take it in, you have to ask yourself why some fellow has never done it before. I am down on combination tools that are fixed up for two or three different jobs, and do not do either of them very well; but this lathe for its regular work is not interfered with in the least, except in the lengthening out of the spindle to get the pinion on, and it does the extra work better than it used to be done in the old way. I got my foundation ideas about machine-shop work in a country shop. We had a very good lot of tools, and we were ready to take any kind of a job, whether we had the tools for it or not, and jacking up a thirty-inch lathe for sixty-inch work was a very common thing. The blocked-up lathe would do boring or any work near the center well enough, but if there was any turning to be done on the outside, like the face of a pulley, it was a very tedious job. The rest had to be run out just as far as it would go, and the block to raise the tool post up to the hight of the center had to be made with an offset, so that it would reach far enough, and we had to use a crooked, springy tool after all. The gap lathe I do not believe was ever deliberately invented for a regular tool, although there are quite a lot of them scattered around, and several tool builders have them in their catalogs. The use of them is, I understand, a vice more prevalent in England than in the United States, but wherever it is found it is only a perpetuation of a makeshift. The first gap lathe was, of course, on wooden shears, and for an emergency job they sawed out the gap and cobbled up the rest, and the land that still clings to the old stage coach body for the design of its passenger cars very properly also clings to the gap lathe, but it should be evermore an indictable offense, in the court of enlightened mechanical opinion in this enterprising land, for anyone with malice aforethought to assist or in any way to aid or abet the construction of another gap lathe. No matter how long your lathe may be between centers the big piece can only swing in the gap, and so the gap lathe is practically only good for chucked work, while with the two-spindle lathe the wheel, or whatever it may be, can be on a shaft or mandrel, and swing anywhere, and be worked at comfortably. The deliberate invention, which the two-spindle lathe is, seems to be in every way cheaper, simpler, and better than either of the makeshifts. If someone will contrive suitable gears for driving without bringing them outside the head stock, he will be giving the finishing touch to the affair. Tecumseh Swift.

Piston Weight and Wear.

Editor American Machinist:

Beg to differ with "Engineman" on some points in his article on "Piston Construction." He seems to labor under the superstition that the weight of the cast-iron piston, as commonly applied, would eventually wear a hole in the bottom of the cylinder. His 60-inch piston is 15 inches deep, and, as per sketch rests with the whole depth on bottom of the cylinder. Supposing $\frac{1}{6}$ of the circumference as supporting the whole weight, we have,

$$\frac{3{,}970}{\frac{d\ \pi}{6}\ 15} = 8.5 \text{ pounds per square inch.}$$

With proper lubrication (and there is no doubt that if any oil goes into the cylinder, you will find it at the bottom) these surfaces will last indefinitely. But I would not construct such a piston, nor employ steam rings. My piston would have packing rings about 6 inches wide, and these rings and nothing else touching the cylinder wall. Then,

$$\frac{3{,}970}{\frac{d\ \pi}{6}\ 6} = 22 \text{ pounds per square inch,}$$

a very reasonable figure, knowing that cast-iron on cast-iron, lubricated, will allow a sliding pressure of $\frac{1}{10}$ of its crushing pressure for an indefinite length of time.

Further, a man who ever gets into a fix, to either spoil his cylinders or his boilers, and not seeing his way clear, sits down and raises a howl, to have somebody come and pull him out of his precarious situation, is not worthy the name engineer, or even to be called an "Engineman." Why is it necessary to throw away the exhaust water? The amount of oil, if the engine is properly oiled, not slushed, is very small, and then there is a cheap and simple way to separate oil from water by gravitation. There are hundreds of ice plants in this country to-day which use this same greasy exhaust in the manufacture of clear, healthful ice for table use, etc., and I would advise "Engineman" to take a good look around, before trying to criticise our engine builders. Those gentlemen who have incidentally the repair work of large engines too, are well versed on the effects of piston and cylinder wear, and know that only outside causes, as faulty adjustment of packing rings, sand and dirt in cylinder, which all go with an ignorant engineer, will cause a piston to cut.

Bridgeport, Conn. H. Hegrodt.

Change of Designs and of Catalogs.

Editor American Machinist:

Intending or possible purchasers receiving catalogs of machine tools with engravings made in or about the Centennial year are very apt to conclude that firms which have brought out no new illustrations since 1878, have made no improvements in the tools themselves. I find that the most capable builders change their designs the most frequently, to satisfy and anticipate new requirements.

Pennsylvania.

Angular Cutters, Lathe Filing and the Monkey Wrench.

Editor American Machinist:

It seems to be a disputed point as to the proper method of marking angular cutters with regard to whether they are right or left hand. It is generally conceded that a right-hand cutter is one that runs in the same direction as a reamer, and this applies to end mills, face milling cutters and angular cutters, when used as they are sometimes for facing surfaces, but when angular cutters are used for milling grooves to form cutting teeth in end mills, etc., then the tooth produced is the reverse of the cutter used; so we find what appears to be according to the rule that applies to tools generally, a right-hand angular cutter marked with the letter L, in connection with the degree of angle and the letter R on one with the reverse cut.

As these letters indicate the hand this seems a departure from truth, but if it is generally understood that these letters R and L, stamped on the cutter, apply not to the cutter, but to the work produced with it, then the only question is as to whether this is the best method of marking, and it is a question on which authorities may differ. From many years experience in connection with tool-room work, as well as from intercourse with the workmen, I am led to believe that the above method is correct, for the reason that when the workman applies at the tool room for angular cutters, he knows what he wants to do, but does not always know what he wants to do it with. If he is required to cut a left-hand end mill he calls for a left-hand cutter, then the letter L on the cutter is a guide for the attendant to furnish the tool required for that particular work.

The tool-room attendant is not always a mechanic; he may be a young man from the farm or factory, and the simpler the form of marking on the tools the more readily he learns the name of each as well as what they are for. So, too, in the shop, the farm and factory hands may become good milling machine hands, and the system adopted in this, as in all things, should be the one that can be most readily understood by the ordinary intellect.

In filing work on centers in the speed or engine lathe, as most workmen are right handed, the general practice is to hold the file with the handle in the right hand, which brings the body in close proximity to the spindle, and to the running belt with its accumulation of grease. The result is often a cleansing process for the belt to the detriment of the workman's clothes; besides there is an element of danger in the liability of catching his sleeve in the lathe dog. This may all be avoided by holding the file with the handle in the left hand, facing toward the head-stock spindle, and any workman can very soon accustom himself to this method of filing on work in the centers, as both hands are in use, and it is not essential to guide the file straight. This is a point worthy the attention of those having apprentice boys under their charge, and for whom they have a large degree of responsibility, as the boys are often naturally careless. They do not take the precaution against danger that the more-experienced workmen will from natural instinct, if not from judgment. It is painful to see the position men will get themselves into sometimes in trying to file short pieces on the lathe centers, when by simply reversing the file in the hand they would be surprised at the ease with which they can adapt themselves to the change.

The monkey wrench, so-called, has been much abused of late. For what reason is beyond my comprehension, for it is the best friend the all-round artisan has in the whole category of tools; always at hand, either yours or some other fellow's, no combination of tools could replace it at the same cost.

Solid wrenches are the correct thing wherever available, and the practice should become universal of having a rack attached to each machine, holding a set of standard wrenches that would take in the whole range of nuts and bolt heads on that particular machine.

My purpose is not so much to discuss the merits of the monkey wrench, or the proper method of its use (that has been pretty thoroughly gone into by others), but a form of monkey wrench has come under the writer's notice recently that possessed a feature that was a step in advance. It was what might be called a thumb latch cam, at the rear of the screw, so that after the jaw was screwed up on to the nut the latch could be brought into play, and the movable jaw forced forward, making it almost equivalent to a solid wrench. This cam is operated by the thumb of the same hand in which the wrench is held.

The weak point of all forms of the screw wrench is the coarse screw and small knurled head, operated by the thumb and finger. There is not sufficient purchase, so that when the strain is brought to bear the jaws spread apart and the result is obvious, especially if the nut or bolt head is worn at the corners. With the cam attachment above referred to the wrench is locked on the nut, and is easily released with a movement of the thumb. If this comes under the notice of the makers of this form of monkey wrench, it is hoped that they will take steps to bring it to the attention of the trade. D. D. D.

Different Kinds of Heavy Drop Hammers.

Editor American Machinist:

I noticed in issue of American Machinist dated October 10th, a communication to the effect that the correspondent had built hammers for many years, weighing 2,500 pounds. The style of hammer referred to is evidently one with a crank lift, and there is practically no limit to the weight of hammer which may be made of this style. Other manufacturers have also made hammers with crank lift or belt lift, weighing even more than 2,500 pounds, and I know of one in use weighing about 6,000 pounds. The E. W. Bliss Company, of Brooklyn, New York, have also built several hammers weighing 3,000 pounds and over, but of a different construction. These hammers are entirely different from the automatic friction roll drops, which have been referred to in the previous communications on the subject, and I believe it to be a fact that the heaviest hammer so far built, of the automatic friction roll type, is one of 2,000 pounds weight. W. B. Bailey.

A New Kink in Calipers.

Editor American Machinist:

A neat and good workman usually owns a good set of tools. In a machine shop forty years ago, two or three home-made calipers and a hammer were about all that was required. The manufacturer of machinists' supplies, however, has gone on inventing new appliances and improving old ones, until anything like a complete outfit is something of which the owner may well be proud.

There are, of course, a few indifferent, one-suspender machinists, who care little or nothing about such things. A boxwood rule and pair of calipers may be carried in the pockets, and a hiding-place can be found

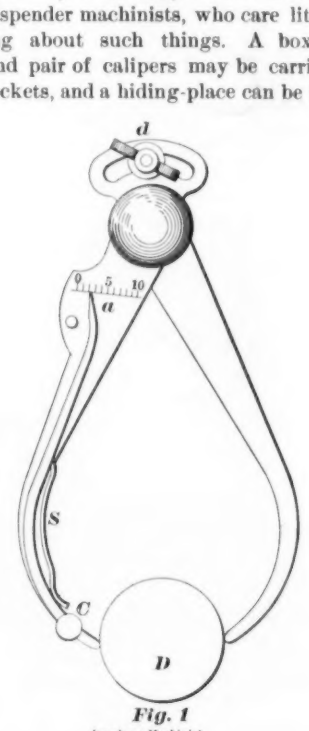


Fig. 1
American Machinist

for a hammer, if such a person is fortunate enough to own one. I do not mean to say by this that the jolly good fellow, though a slouch, is always a poor workman, nor that the display of a fine set of tools is positive evidence, always, of a good mechanic. While the rule may hold good in most cases, I have known some notable exceptions to it.

In the tool maker's art there is perhaps nothing that requires more delicate or refined workmanship than that of producing modern measuring devices. To a certain extent the micrometer has doubtless superseded standard rules and calipers. Yet I think it safe to say that there is no class of tools used by the machinist which is of more general utility than calipers, and strange to say, these are essentially what they were forty years ago.

The inclosed sketch represents what I think may be regarded as an important improvement along this line, as I shall endeavor to demonstrate by reference to some

of the ordinary everyday operations performed by the lathe hand. In turning a piece of iron to size, the painstaking workman will set one pair of calipers to the rough size desired, and another to the size he wishes to finish the piece, or if he has but one pair at hand which are suitable, two settings of these will be necessary. With the calipers which are illustrated by Figs. 1 and 2, all that is required is to set Fig. 1 to

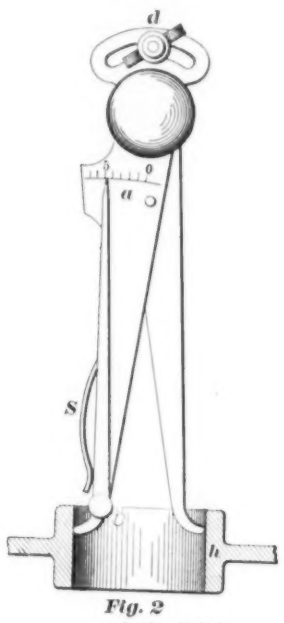


Fig. 2
American Machinist

the finishing size, with the pointer *a* resting at zero. When the rough cut is being taken the caliper may be readily passed over the shaft *D* and the exact allowance above the finishing size will be recorded on the scale as seen at *a*. On removing the caliper the pointer returns to zero, restoring the exact finishing size, so that the roughing cut may be adjusted as it progresses, and as many trials made as is desired, without the slightest danger of deranging the calipers, a thing which all lathemen know to be very difficult to do with the ordinary riveted or even spring calipers.

Again, if it is desired to make a shrinking fit, or one to be pressed on, with any given amount of force, the caliper may be set to the exact size of the hole to be fitted, and as the auxiliary point of the caliper passes over the shaft, the requisite size may be read on the scale; this, of course, having been determined by previous experiment. Should the shaft be already turned, and a hole is to be bored of proper size, then the inside caliper, Fig. 2, will indicate in the same way, to the greatest nicety, just how much to allow for making the desired fit.

When the index pointer *a* is to be adjusted or replaced each time by hand in place of the spring *S*, there should be a slight amount of friction at the rivet. If for any reason it should be found desirable, a light spring may be employed, as shown at *S*. This will always return the pointer to its position at zero, after the caliper has gone over the shaft. In this case it will be necessary to note the extreme movement of the point at the index, while the caliper is on the largest part of the shaft—a thing not necessary when the spring is omitted. It will be readily seen that the inside caliper may be made available in sizing a hole to suit a given size of shaft. To do this both calipers may be set to the exact size of the shaft, and made fast here by means of the holding screws *d*. While the point of the outside caliper is free to move outward, that of the inside caliper will move inward, and when placed in a hole anything smaller than the shaft, will show exactly how much smaller it may be. So that by this means a very minute yet definite allowance may be made, depending on the nature of the work in hand. The cut, Fig. 2, shows a sectional view of a hub *h*, which is five points smaller in the bore than is the caliper when withdrawn and brought to the zero point, which represents the exact size of the shaft to which it is to be fitted.

This ingenious device is the invention of W. J. Gladish, of Chattanooga, Tenn. A practical test has been made to prove the efficiency of the tool, and we understand an effort will be made at once to place it on the market. "QUIRK."

[This "ingenious device" has been invented over and over again. We have seen it many times.—ED.]

Brazing.

Editor American Machinist:

In a late number of the MACHINIST a correspondent inquires regarding brazing. With your permission I will give him a few ideas of the art. As he has only a charcoal fire his brazing must be on the top and the bottom, or where the heat is applied, consequently he must be on guard, or he will burn his work before the brass melts. He can get brass granulated like the sample inclosed from dealers in machinist's supplies. This comes in four sizes—coarse, medium, fine and extra fine. Medium will cost 40 cents per pound. If he does not do enough to make it an object, he may take any sheet brass or brass wire, and with a coarse file he can in a short time make enough to do a small job with.

Borax he can get at any drug store, and by pounding it fine and placing on a shovel in a moderate heat he can expel the moisture, when he can again grind it as fine as he chooses; this is, provided he cannot get the pulverized. Before applying the brass solder he had better wet the article to be brazed, and then dust the pulverized borax in liberal quantities over the joint to be made. With an iron he can transfer the borax along the seam, then when melted he can take his brass solder already mixed with pulverized borax, and distribute along where the joint is to be closed, and when it is reduced to a flowing or molten state remove from the fire. After it is cooled he can clean by immersing the job in a pickle of sulphuric acid and water, taking care not to have it strong enough to attack the iron or steel. The object of the borax is to prevent scaling of the iron and oxidization of the brass solder, which latter will otherwise be burnt up, and no good done. I have never had any difficulty in doing this class of work, in fact, had rather do it than attempt to mend a rusty wash boiler with tinner's solder.

He must remember that in all cases the article to be brazed must have greater heat-resisting power than the solder, or the article will melt first. Brass solder is only copper and spelter, same as low brass, and is used by those doing large quantities of work, on account of its convenience.

The pickle attacks the melted borax, and cleans the work ready for the file. Otherwise the file will soon go to the bow-wows.

OLD BRAZER.

A Case of Maintenance of Pressure in a Boiler.

Editor American Machinist:

The article on page 787 of the issue dated October 3d, by Frank Cawley, on "Why the Pressure in a Steam Boiler Remains Nearly Constant During Blow-Off," brings to mind an accident occurring several years ago in a Western Indiana town.

A concern making nail kegs "from the log" employed as night watchman a man of fair intelligence but of very limited experience in the care of a steam boiler. His duties included, besides the ordinary watching and keeping up steam through the night, the cleaning of the boiler (an ordinary "two-flue," about 40 x16 feet) when necessary.

On this occasion, which was the first after his employment as watchman, not liking to work on Sunday, he arranged with a helper detailed for the purpose, to blow out after work hours on Saturday evening, and clean out at night. They accordingly opened the blow-off and went to supper. Returning they removed the bridge holding the manhole plate in place, but found that the plate would not drop. They pushed it in slightly several times, but found that, to use the watchman's expression, it would "flap back" in place each time.

After experimenting for some time and discussing the singular behavior of the plate, they became impatient, and the watchman with a 4x4 scantling for a battering ram drove the plate inside the boiler.

Instantly on removing the plate a stream of water the full size of the manhole gushed forth, overturning both men, and scalding the helper so badly that he died within 48 hours, and while the watchman recovered, he was frightfully scalded, and his life hung in the balance for weeks.

The accident caused much local speculation, and while various theories were advanced, the cause was never officially determined.

The opinion formed by the writer was that the boiler was very foul; that the blow-off valve became clogged with scale shortly after it was opened, very little water having escaped. The weather being extremely cold, the boiler and furnace cooled down during the time the men were at supper, until the pressure was only a few pounds above that of the atmosphere, which, of course, means that the water was somewhat above 212 degrees temperature, or the ordinary boiling point, and when the boiler was opened there was sufficient pressure to force the hot water out, and sufficient hot water to maintain the pressure for a short time by evaporation into steam.

The comment of the watchman in relating his experience was "that it was not always safe to take chances on beating the fool-killer." STEEL.

Circular Measurement.

Editor American Machinist:

Your correspondent, Mr. Booth, seems to question the accuracy of what I said regarding the length of a strip of paper encircling a disk. I said, in substance, that we must add three times the thickness of the paper to the actual circumference, in order to make the ends of the strip meet wound around the disk. He says that it is needed only to add the one thickness of the strip to the actual circumference. I don't know what authority he speaks from, but I speak from actual experience in the case (possibly things don't work across the water as they do here in New England). Now, to make it a matter easy to determine, we will not use a strip of thin paper, but we will use one very much thicker and more pliable than the ordinary thin paper. I have before me a turned steel disk, which by micrometer gage is 1.626 inches in diameter, and $1.626 \times 3.141 = 5.1072$ inches in circumference; I have a strip of paper $\frac{1}{2}$-inch wide which is .037 inch thick, and I cut that strip off its end until its ends exactly encircle the disk 1.626 inches in diameter. I find that its length is 5.2187 inches.

$5.2187 - 5.1072 = .1114$; $.1114 \div 3 = .0371$ inch, the thickness of strip. Let us put the problem this way: 5.1072 inches is the circumference of disk, .0371 is the thickness of strip of paper, $.0371 \times 3 = .1114$, $.1114 + 5.1072 = 5.2186$ inches; these measurements are obtained by micrometer and micrometer gage, so that there is no mistake or guess about the case. Again, Mr. Booth tells us that in this matter of a belt encircling a pulley or disk there occurs a natural pitch circle. Exactly so, and that pitch line is $\frac{1}{2}$ the thickness of the material which is used; if we make only $\frac{1}{2}$ encircling of disk, as in the case of belt and pulley, then we add only $1\frac{1}{2}$ the thickness to the circumference; but in the case of entire encircling then this rule of adding 3.141 times the thickness of material holds good in practice, in belting or other work of this kind. I have other data on this subject, but this must do for this trip. F. W. CLOUGH.

Removing the Air from Steam-Heating Coils.

Editor American Machinist:

To Mr. W. H. Wakeman's excellent instructions to Mr. Hyde for heating his shops, given in your issue of October 3d, should be added attachments for the sure and automatic removal of the air from the coils and radiators. Only positive means will perform this function.

To each coil or radiator, instead of the usual pet cock, attach an adjustable automatic air valve by a piece of $\frac{1}{4}$-inch pipe about three or four inches long, connect all the air valves by a $\frac{1}{4}$-inch pipe to a $\frac{1}{2}$-inch air main, which is to follow the general course of the return main; run this air main to the boiler or engine room, at which point attach an ejector operated by live steam from the boiler; run the outlet pipe from the ejector outdoors either directly, or through the main exhaust pipe to roof, connecting in the latter outside of the back pressure valve.

One-half-inch pipe is large enough throughout the building for the air main for ordinary cases, say, up to 5,000 square feet of pipe surface; above that amount of surface the air main in basement may be $\frac{3}{4}$-inch pipe to ejector. All of the air piping must be air-tight.

A No. 1 ejector will take care of 1,000 square feet, and a No. 2 ejector will take care of 5,000 square feet of pipe surface.

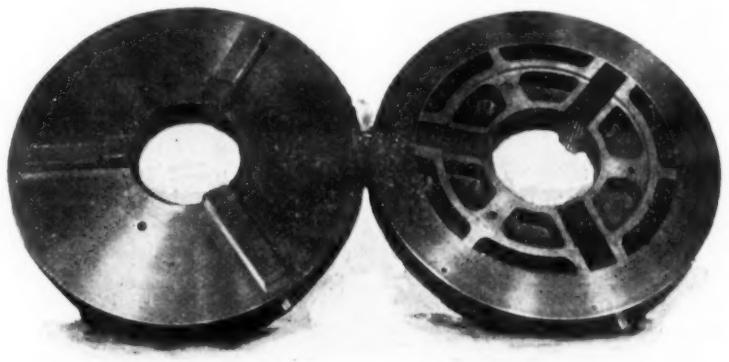
Where more surface is to be provided for, the air system should be divided into units of about 5,000 square feet each.

On the air main, both to and from the ejector, place a swing check valve, and on the steam supply pipe use a globe valve, these valves to be of the sizes called for by the ejectors' connections, and close to it.

A small combination steam and vacuum gage placed in the heating main convenient to the eye of the engineer, will inform him of the condition of pressure in the heating system.

By the use of the above, the air will be expelled as rapidly as accumulated by the process of condensation, therefore relieving the engine of back pressure and maintaining the heating surface in lively working condition.

This method of expelling the air from heating systems is illustrated by Pictet, in his "Treatise on Heat," published in 1860, as having been done by M. Pelletan, and is therefore common property. H. E.



SPECIAL LATHE CHUCK.

Special Universal Chuck.

We give two views of a three-jaw universal chuck, built by The Skinner Chuck Co., of New Britain, Conn., on a special order, to be used on a cutting-off machine. Two of the chucks were made, one for each end of the spindle, and the opening through the center is $9\frac{3}{4}$ inches diameter. The body of the chuck is 30 inches diameter, the recess at the back for the face plate, 18 inches diameter, and the length of "bite" of jaws is $5\frac{1}{4}$ inches.

The machine they were made for is intended to cut off stock from 2 inches to $9\frac{1}{2}$ inches diameter, and all parts of the chucks were made unusually heavy and strong.

AMERICAN MACHINIST

PUBLISHED EVERY THURSDAY
BY THE
AMERICAN MACHINIST PUBLISHING CO.,
203 BROADWAY, NEW YORK.

Fred J. Miller, Pres't. Chas. W. Biglow, Treas.
C. A. Hansmann, Sec'y.

Fred J. Miller, Editor.

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Subscription.

$3.00 a year in advance, postage prepaid, in the United States, Canada, and Mexico.
$4.00 a year to Other Countries, postage prepaid.

Advertising.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

The American News Company,

New York, is the Publisher's Agent, and dealers are supplied by all its branches throughout the United States and Canada.

For Europe:

The International News Company, Bream's Bldg's, Chancery Lane, London, E. C., Eng., will receive subscriptions for the American Machinist at 16/6 per annum, English currency, or 17 marks per annum, German currency, postpaid.

Subscriptions received in Paris, France, by E. Terquem, 31 Boulevard Hausmann, at 21 francs per annum, postpaid. Subscriptions received in Australia by W. Williams, 17 and 21 Fink's Buildings, Melbourne.

Continental Office:

LEIPZIG, Germany. Oscar Neuman, 27 Elster Str.

Chicago Office: 206 La Salle St.,

Wm. D. Mahaney, Agent.

New England Office:

Dorchester, Mass., 4 Church St.

John A. Walker, Agent.

NEW YORK, OCTOBER 24, 1895.

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The Persistence of Ignorance.

Elsewhere in this issue we publish a letter from a mechanic giving his experience in trying to reform the practice of a benighted machine shop, and how, in this instance, ignorance and darkness triumphed over intelligence and light. That the failure to put new ideas into this shop was not wholly if at all due to shortcomings of our correspondent who tried it, is shown by the fact that he is now the successful superintendent of another shop, and the case affords a somewhat interesting example of the persistence of ignorance in the face of what may be termed the nineteenth century discouragements of ignorance.

As a contrast to this case we may be pardoned for mentioning the experience of a young friend of ours who was making a bicycle tour in a far Western State. In a region far from a railroad, and where he expected to find little evidence of "up-to-dateness" in mechanical matters, he spied a small machine shop, and went into it expecting to find some curiosities. He found them, but they were different from what he expected. He noticed that things were clean and in order, and that there were about the shop numbers of the very newest and latest tools and devices for facilitating such work as was being done there—things which he himself, with what he thought his superior opportunities, had only just learned of the existence of. Soon he found some copies of the American Machinist lying about and understood. They had simply been making use of one of the before-mentioned discouragers of ignorance, and were up with the times so far as their circumstances permitted.

But the persistence of ignorance is to be seen in other matters, as is shown by the experience of an engineer who is interested in a certain boiler of modern type. He mentioned the case of a man who did considerable wood-steaming. His original factory was in the city, where his steam room was surrounded by brick walls, and was accidentally well protected from radiation and from currents of cold air. He built a new factory in the country, and placed his steaming chamber on brackets at the side of a building, made its walls of corrugated iron, and, in fact, arranged it for the greatest possible radiation and loss of heat. Then he complained that his new boiler was no good, because he burned more fuel than with the old one.

Another man dug a well to supply feed water. Lots of scale formed, and upon his complaint of unsatisfactory working, he was recommended to get a live steam purifier. He put in a "Hoppes," but in a short time complained again that his boiler was not working right. An examination showed that he had supposed that the purifier would go right on taking care of impurities without further attention. The purifier was found to be *filled solid* with scale, except small passages through which the feed pump had been forcing the water with such a current as to prevent further deposition of scale.

Another man ordered a boiler, and said he would use a certain specified stoker. After the boiler was received, he concluded not to use a stoker, and fired it in the usual way. It required a long trip by rail, and the work of raising his grate bars 12 inches to stop his complaints of poor steaming and waste of fuel.

Another man complained that the boiler furnished wet steam, and nothing could be done with him until by taking a long trip it was discovered that he was carrying steam through 75 feet of 10-inch steam pipe outdoors entirely uncovered, and fully exposed to the cold breezes blowing off a northern lake, upon the shore of which the factory stood.

Such examples of ignorance seem almost incredible to one who, himself possessed of ambition, is unable to understand how a man can bear to be engaged in a certain line of business with the intention of remaining in it, and yet shut himself off from every avenue by which intelligence may reach him, make of himself a clam, and then, too often, because he has heard so little of what there is to be known, imagine he possesses all the knowledge that is obtainable.

Such cases make trouble, but there is consolation in the thought that there is perhaps all the better chance of success for those who are willing to think and to profit by the experience of others.

What Nobody Knows About Trolley Cars.

We occasionally see in the columns of the daily press accounts of the saving of lives by the trolley car fenders. If the cases are looked into, it is found that if the fender does not actually kill its victim it is credited with saving his life; whether it deserves the credit is what nobody knows. The latest case was in Jersey City, October 15th. A boy, six years old, was playing in the roadway in front of his home when he was struck by trolley car No. 30, of the Bayonne line. He fell in the fender. He received slight cuts in the head and hands. Whether any part of the car would have touched him at all if the fender had not stuck out three or four feet in front of it, and especially if the car had been equipped with a quick-acting brake, is what nobody knows.

In the Superior Court of the City of New York, a case was tried on October 11th in which it was proved that a street car ran from a straight track on to a curve at such a speed that a man standing upon the front platform was thrown off with his leg under the car, but that the car was stopped just as the front wheel pinched his leg, but did not go over it. This happened to be a horse car; how long it will be before it will be possible to stop a trolley car as quickly as that is what nobody knows.

We have had occasion to ask, and to reiterate the question:

"Is it true or is it untrue, is it acknowledged or is it denied, that an electrically-driven car upon a street railway, a trolley car, either an overhead trolley or an underground trolley, and especially, and for an additional reason, a car operated by a storage battery, cannot, either of them, *with safety to itself*, be stopped as quickly as any other car of the same capacity and running at the same speed? Is it true or is it not true that electric cars are purposely equipped with slow-acting brakes, and that human lives are being sacrificed for the safety of the motor mechanism?"

This is answered by the *Electrical Engineer*, as follows:

We wish to say that it is untrue. We desire to deny the existence of any such state of things. We affirm positively, flatly, absolutely and finally that the facts are wholly otherwise. We never saw even the idea mentioned until our friends propounded it. We have been associated with the electric railway industry very actively ever since there was a street car run by current of any kind, and we have never known, and have never met, and have never heard of, an electrical engineer who objected to air brakes, or quick brakes of any kind because of danger to the motor mechanism. If our contemporary would like this stated more strongly, we shall be glad to oblige it in that way; and we insist once more that *all electric cars ought to have air brakes.*

This is evidently written by one who knows; but how it is to be reconciled with the following from that other electrical journal, the *Street Railway Review*, is what nobody knows. It says:

If the editor of the American Machinist can devise a successful friction clutch drive for electric motor cars, he can do more than the *many eminent engineers that have worked on the problem up to date.*

The William A. Harris Steam Engine Co. recently put a twin compound condensing engine intended to develop a maximum of 2,000 horse-power, and regularly 1,500 horse-power, into a mill of the Massachusetts Cotton Co., of Lowell. The cylinders are 32 inches and 56 inches diameter, 6 foot stroke. The engine is condensing and steam jacketed, barrels and heads. During a recent test it was supplied with steam from two Babcock & Wilcox boilers of 250 nominal horse-power capacity each, and developed 1,600 horse-power on a coal consumption of 1.4 pounds of coal per hour per horse-power, steam being carried through 600 feet of piping exposed to the air and with numerous bends. At least this is the claim made, though we do not know upon what authority.

The late Hesekiah B. Smith, who was a machinery manufacturer of Smithville, N. J., made a provision in his will by which $200,000 was to be devoted to establishing and maintaining a school in which boys were to be taught the machinist trade and other things. A recent decision of the courts invalidates this provision of the will on the ground that it is not clearly enough defined to enable the wishes of the testator to be certainly carried out.

Col. A. B. Shaw, of Watertown, N. Y., Prof. R. H. Thurston, of Cornell University and E. W. Bliss, of Brooklyn, have been appointed members of a commission which is to select a magazine shoulder gun for the National Guard of New York State. Only American arms will be considered, and an order may be given for 15,000 guns at a cost not exceeding $20 each.

Literary Notes.

NOTES ON DESCRIPTIVE GEOMETRY, WITH EXERCISES. By Wm. L. Ames, Professor of Machine Drawing and Design, Rose Polytechnic Institute, Terre Haute, Ind. Second Edition.

The object of this book is best stated by quoting the preface. "It is evident to all who have taken note of the trend of the practice in mechanical drawing in the best drafting offices, that the use of the third quadrant in projecting will become universal.

"In the study of Descriptive Geometry, however—with few exceptions—the first angle projection is taught. The writer, realizing that the methods taught should harmonize with the practical application in mechanical drawing as practiced, has for some time used the third angle in teaching Descriptive Geometry. There being no text-books so arranged, notes were prepared for the students' use, and with such revision as four years' use in the class room would seem to indicate as desirable, these notes are now published."

The examples are well chosen, and their arrangement is well adapted for an easy and progressive study of this important science. It is, however, to be regretted that better and larger illustrations have not been used; on many of the cuts the letters are so small as to impede a ready reference, and thus interfere with the study of the subject. The workmanship of the cuts is poor, which, we think, is a serious defect in books intended to help in teaching drawing, where neatness of execution is important. The book is published by Moore & Langen, Terre Haute, Ind. It is well bound, and contains 88 pages, 6 by 4½ inches. Price, 50 cents.

ALTERNATING ELECTRIC CURRENTS. By Edwin J. Houston, Ph. D. (Princeton) and A. E. Kennelly, Sc. D.

This volume cannot fail to attract the attention of the reader by its simplicity, and the clearness with which the treatment of the important subject of alternating currents is presented. The first chapter deals with the principles of alternating currents, the explanations of which are made exceedingly plain by mechanical analogies, which are used throughout the book wherever a conveyance of clear conceptions demands them. The remaining nine chapters are devoted to alternating electromotive forces and currents; uniphase alternators; power transformers; electric lamps; electric motors; multiphased currents; and multiphase motors. The fundamental principles underlying the difficult branch of electrical engineering of which the book treats are presented in the simplest language, as free as possible of technicalities, and without the use of mathematics further advanced than ordinary arithmetic. The non-technical reader should have no difficulty in understanding the authors, or in obtaining a comprehensive knowledge of the subject; and the element-

ary electro-technical student will find this work to be useful and instructive; the treatment of the subject being such as to attract attention at once, and it does not lag in interest to the end. The reliability of the information given is sufficiently guaranteed by the names of the authors.

This book is the first of ten volumes of an "Elementary Electro-Technical Series," designed to give concise and authoritative information concerning those branches of electro-technical science having a general interest.

The present volume contains 225 pages, 6½"x5"; it is well illustrated and substantially bound. It is published by The W. J. Johnston Company, 253 Broadway, New York. Price $1.

Three men were killed by the collapse of a roof of a blast furnace of the Cleveland Rolling Mill Co., October 12th, and two days later a serious accident, by which a number of men were badly if not fatally injured, occurred at the American Iron Works of Jones & Laughlin, at Frankstown, Pa. The latter accident was a fall of converters, and the injured men were burned.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet. We cannot undertake to answer questions in "next issue." This department is usually crowded, and questions must wait their turn to be answered. Neither can we undertake to solve mechanical or engineering problems, and send answers by mail.

(377) W. H. W., Baltimore, Md., writes: Kindly inform me if there is a work published which treats on the laying out of cam motions. *A.*—We do not know of any work which treats exclusively on this subject. In "Elementary Mechanism," by A. T. Woods and A. W. Stahl, you will find considerable space devoted to this subject.

(378) G. M. T., ——, writes: I have a block of brass having a hole in it .034 inch diameter. I wish to ream this hole to .036 inch, and to produce a very high polish on the interior surface of the hole. How would you advise attempting? *A.*—We should do it by lapping, using lead wire or wood lap charged with polishing material. We should, if possible, run the lap at high speed in a small drill press, being careful to keep the spindle moving vertically to avoid making rings.

(379) F. S., Indianapolis, Ind., writes: Please give rule for finding the number of flues which can be placed in a circular boiler head, a rule that will apply to all sizes of flues and distances between them. *A.*—The graphical method is the best one for the solution of problems of this kind. On a sheet of paper draw the center lines of the tubes, and on these center lines lay a sheet of tracing paper with the circumference of the boiler head drawn upon it. In this way you can determine at once the number of flues which can be placed in the head.

(380) F. B., Louisville, Ky., writes: Please give me an idea of how horseshoes can be melted and cast in the same manner as cast-iron. *A.*—Probably the best way to melt them is directly behind a heat of cast-iron. As soon as a charge of cast-iron begins to settle away from the charging door put on a quantity of coke suitable for the charge of horseshoes to be melted, and keep the cupola full until the last charge has been put in. We have some doubt as to the success of making castings from this material, we believe that better results will be obtained by mixing with cast-iron. It is said that as high as 33 per cent. in mixture with cast-iron melted in a cupola has been used. Considerable experience is required in the union of wrought-iron and cast-iron, and the exact mode of procedure can, in our opinion, be acquired only by experimenting.

(381) J. H. B., Syracuse, N. Y., writes: We are desirous of obtaining some information of the methods employed for coloring highly finished parts of gun mechanism after being hardened—the process must not soften the parts. *A.*—A variety of colors on iron and steel, by means of the following mixture, can be obtained, the colors altering with the time of immersion. Lead acetate, 50 grains; sodium thiosulphate, 50 grains; water, 5 fluid ounces. The solution must be used hot. The colors obtained will be: 1, light brown color; 2, darker brown color; 3, purple and blue mixed; 4, purple and blue, paler tone; 5, beautiful uniform light blue color; 6, steel gray; 7, black color, after half an hour's immersion. For producing a uniform color all over, the article must be completely immersed, so as to be equally heated. We should advise you to experiment with this solution before using it to any great extent.

(382) J. P. S., New Orleans, La., writes: Kindly inform me of a good practical book treating on electricity, from which a mechanic of ordinary intelligence can get some practical information relating to dynamos and motors; how to wire motors ready to run; difference between motors and dynamos; explanation of switches; resistance; difference between incandescent and arc lamps, and how to hang electric bells. *A.*—You will need several books for obtaining the information asked for. The information obtained from the so-called practical books, however valuable this may be in everyday practice, will not be as satisfactory as when a person has some theoretical knowledge of the subject. If you have no knowledge of the elementary principles, we should advise you to study S. P. Thompson's "Elementary Lessons in Electricity and Magnetism." After this, take up "Alternating Electric Currents," by E. J. Houston and A. E. Kennely; and after these books have been read, you can make excellent use of "Practical Management of Dynamos and Motors," by F. B. Crocker and S. S Wheeler. All these are excellent books and will amply repay you for time spent in their perusal.

(383) K. & C., Lebanon, Ind., writes: I have in mind two boilers furnishing steam for two compound condensing engines. One quart of a cheap, well-known cylinder oil goes through each engine in 12 hours, and the water and oil from the condenser is pumped back into the boilers. All the rivets, joints and flue ends in the boiler leak considerable at times. I claim that all these leaks are caused by the quantity of oil returned to the boiler. Please state what, in your opinion, is the cause of the trouble. *A.*—To return oil into the boilers is very bad practice, and can be avoided by the use of separator placed between the engine and boiler. Oil in boilers will sometimes cause pitting; but it is doubtful if the oil is the whole cause of the leakage. The acids in the water and the quality of the iron may also be the cause of the trouble. The water in some localities, whilst but slightly acting upon the body of the plates, attacks the rivet heads or edges of the plate and angle irons. Sometimes it happens that it is mainly the transverse seam rivet heads and plate edges thut are attacked, and sometimes the longitudinal seams. The cause of the leakage cannot be located without a thorough examination of the boiler and the water.

(384) E. E. P., ——, Ohio, asks: Can a locomotive of the most powerful construction and worked to its utmost capacity raise its own weight at the rate of 20,000 feet per hour? *A.*—No. 2. Please give the tensile strength of the rawhide used experimentally for a cannon. *A.*—We do not know what quality of rawhide was used for this purpose, and therefore cannot answer your question. 3. Can the best kind of steel withstand a tensile stress of 275,000 pounds per square inch? *A.*—No. 4. Which is the stronger, steel or wood, according to weight? *A.*—This is a very indefinite question; there are many different kinds of timber, and also various grades of steel. Comparison between the strength of steel and timber, according to weight, can be made which will show that the steel is the strongest, and others will show the opposite. 5. I have read that a good horse can develop for a few minutes several horse-power; is this true? *A.*—A horse of the average weight and condition should do a day's work at the rate of about two-thirds of a horse-power unit, or 22,000 to 25,000 foot-pounds per minute for the day. A powerful horse may give a full horse-power, and any animal may do for a short time vastly more than its average rate of work. 6. Cannot an engine of good construction develop for a short time several times its rated power? *A.*—Yes, and in the same time fly into a scrap heap, too. Your other questions are out of our line.

(385) Crank Pin, Annotto Bay, Jamaica, writes: I am in charge of a set of compound marine engines fitted with Marshall's patent valve gear, which has one eccentric only for each engine. I inclose you a set of indicator cards taken in her usual running trim. There is no method of expansion except linking up, which affects both engines. When driven up to their full power, the indicated horse-power of both engines is more even, but this occurs very rarely. I would be pleased if you will inform me how I can, by altering the valves, improve this, get more power out of the low-pressure cylinder, and do away with this excessive throttling, as the speed of the engine has actually to be regulated by the throttle valve. Any alteration which means expense will not, I am afraid, be approved of, but any improvement on the present condition of things will mean a reduction in the coal consumption. *A.*—The cards you have sent us are, on the whole, very good ones, with the exception of the throttling. This, we believe, is not due to any defects in the valves, but is due to a slow movement of the valves. We therefore do not see how any alteration of the valves will give better results. A remodeling of the whole valve gear may give more satisfactory results, but this will be too expensive. 2. Please give the title of a book on valve design and construction, one which mentions this gear. *A.*—"Manual of Marine Engineering," by A. E. Seaton, treats on this subject. This, we believe, will be a very good book for you to have at hand. You will also find this valve gear illustrated and explained in "Valve Gears for Steam Engines," by C. H. Peabody.

(386) S. T., ——, writes: Kindly inform us of the process used for causing melted cast-iron to adhere to steel when the former is poured on or around the steel. *A.*—In the process of burning on to, or attaching cast iron to steel, it is necessary that the temperature of the two metals be as near equal as possible before pouring, so as to avoid the danger of rupture from internal strains. Therefore the steel should be heated to a temperature as high as possible, and set in a suitably prepared dry mold which should be instantly closed, and the hot iron dropped from a considerable hight directly upon it by runners sufficient to cover the piece and effect a junction quickly; otherwise the process is rendered inoperative by the metal simply running over it and out at the escape at a gradually decreasing temperature. A superior union is always effected when the body of cast-iron is large, because then the steel is under the influence of the fluid metal for a greater space of time. The outlet in the mold should be lower than the inlet gate so as to create a current, upon which mainly depends the success of the operation. The gates can often be formed and the mold so placed as to have the hot cast-iron flow over the exposed surface to the outlet. In some cases there may be a necessity for more than one outlet as well as inlet. The point to be aimed at is to have a dead fall upon all possible exposed parts and an outlet from the same if practicable. Dry sand or loam mold generally give the best results as the dropping and washing of much running iron will often cause a green sand mold to produce a rough-skinned job and cause dirt in the mold, which, of course, is injurious to the work. Cast-iron for burning purposes should be very soft, and the temperature of the melted iron as high as possible. The reason for giving soft iron the preference is simply because the soft iron does not chill as quickly as hard iron and will retain its fluidity longer, and form a stronger union. When the pouring is nearly completed the outlet should be quickly stopped; after this the pouring should be quickened until the mold is filled. For a successful job, good judgment and experience is required, as the exact operations suitable for one job will seldom do for another.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 852.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Patent Solicitor. J. G. D. Mack, Madison, Wis.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Engrs. should investigate the Korting Condenser. Obtain Catalog from A. Aller, 109 Liberty St., N. Y.

Marine Iron Works, Chicago, builders of steam yachts and marine machinery; catalogs free.

Best Presses and Dies for all sheet metal work, Ferracute Machine Company, Bridgeton, N. J.

Just issued—Catalog No. 8. Mailed Free. Clayton Air Compressor Works, 28 Cortlandtt., New York.

Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N.Y.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

Key Seaters for any length of hub or width of keyway. New, handy machines. Mitts & Merrill, 913 Tilden street, Saginaw, Mich.

Thin emery wheels, for cutting slots, etc., a specialty. The Tanite Co., Stroudsburg, Pa.; 141 Washington street, New York; 139 East Pearl street, Cincinnati, Ohio.

"Practical Drawing," by J. G. A. Meyer; used by engineering schools in lieu of text-book; the set of 92 papers sent to any address in the United States for $5. American Machinist, 253 Broadway.

Calculating the Horse-Power of Boilers.

By W. H. Wakeman.

There are two standards by which we may calculate the horse-power of our boilers, which are as follows: 1st. The evaporation of 34.5 pounds of water per hour when the feed water is supplied at a temperature of 212 degrees, and the pressure is at zero by the gage. 2d. The evaporation of 30 pounds of water per hour when the temperature of the feed water is at 100 degrees, and the pressure is 70 pounds by the gage. Let us compare these two standards and note the difference, if there is any.

In order to evaporate one pound of water at 212 degrees into steam at atmospheric pressure at sea level, we must put 966 units of heat into it, and to evaporate 34.5 pounds the amount will be $34.5 \times 966 = 33{,}327$ units. In order to evaporate one pound of water when the temperature of the feed water is 100 degrees into steam at 70 pounds gage pressure, we must put 1,109 units of heat into it, and if we wish to evaporate 30 pounds the amount will be $30 \times 1{,}109 = 33{,}270$ units. A comparison of the two amounts shows that the difference is not worth considering in such a case as this, therefore we may use either standard, selecting the one which suits us best. I prefer the latter.

Now suppose that we want a 100 horse-power boiler. Then we must build one that will evaporate $30 \times 100 = 3{,}000$ pounds of water per hour from 100 degrees into steam at 70 pounds gage pressure. If we calculate that 2 pounds of water will be evaporated for each square foot of heating surface under the above conditions, then $3{,}000 \div 2 = 1{,}500$ square feet of heating surface required. But we do not wish to use our boiler under these conditions, for we intend to supply the feed water at 210 degrees, and mean to carry 100 pounds pressure. The sensible heat of steam at 100 pounds gage pressure is 338 degrees, and the latent heat is 876 degrees, therefore, in order to evaporate one pound of water under these conditions, we must put $338 + 876 - 210 = 1{,}004$ units of heat into it. We must now find out how many pounds of water we shall have to evaporate, where each pound evaporated requires 1,004 degrees, in order to equal the evaporation of 30 pounds where each pound requires 1,109 degrees. It is an example in proportion, for 1,004 : 1,109 :: 30 : 33.13. By this we see that we shall have to evaporate a trifle over 33 pounds per hour under these conditions. This will require no more heating surface than before, for although we have to evaporate 3 pounds more of water per hour, the total heat for 70 and 100 pounds pressure is nearly the same, and the feed water is 110 degrees warmer. Suppose that we have five of these boilers, and want to know how much power we can develop with them in a triple-expansion engine which requires 12 pounds of steam per horse-power per hour. It has become an example in proportion as before, for 12 : 30 :: 500 : 1,250. Therefore we can develop 1,250 horse-power in this engine with 500 horse-power of boilers.

Again, let us suppose that we have one of these 100 horse-power boilers with 1,500 square feet of heating surface, and wish to use an engine that requires 50 pounds of steam per horse-power per hour. In this case the proportion is as follows, for 50 : 30 :: 100 : 60, showing that we can develop but 60 horse-power in this engine with one of these 100 horse-power boilers.

If we have a building to heat that requires 5,000 square feet of direct radiating surface to keep the temperature up to 70 degrees with 5 pounds pressure of steam, the feed water to be supplied at 210 degrees, and want to design a boiler for it, we must first ascertain how much water it will be necessary to evaporate. The temperature of steam at 5 pounds gage pressure is 228 degrees, and $228 - 70 = 158$ degrees difference of temperature between the steam and the room or building to be heated. There are 5,000 square feet of radiating surface, and $158 \times 5{,}000 = 790{,}000$. This is to be

divided by 420, because it has been ascertained that $\frac{1}{420}$ of a pound of steam will be condensed per hour per square foot of radiating surface for each degree difference of temperature. 790,000 ÷ 420 = 1,881 pounds of water per hour. To evaporate one pound of water under these conditions calls for 982 units of heat, while with the standard adopted for these calculations and comparisons, it requires 1,109 units, therefore when we want to ascertain how much boiler power to provide we have another example in proportion, for 982 : 1,109 : : 30 : 33.8, or nearly 34 pounds of water must be evaporated under these conditions to make one horse-power. We have already found that we must have 1,881 pounds of water evaporated per hour, and as 34 pounds under these conditions constitute a horse-power, 1,881 ÷ 34 = 55 horse-power of boiler needed. Calculating on an evaporation of 2 pounds of water per hour per square foot of heating surface, and 30 pounds of water from 100 degrees into steam at 70 pounds pressure as one horse-power, we have 30 ÷ 2 = 15 square feet of heating surface for one horse-power. 55 × 15 = 825 square feet of heating surface needed.

The foregoing is intended to demonstrate the fact that the horse-power of a boiler is a certain well-defined quantity, and also that the horse-power of a boiler has no connection with the horse-power of an engine, neither does it make the slightest difference in the rating of a boiler to state for what purpose the steam is to be used, as that remains the same whether we use the steam to run a triple-expansion engine, or for the purpose of boiling swill for pigs.

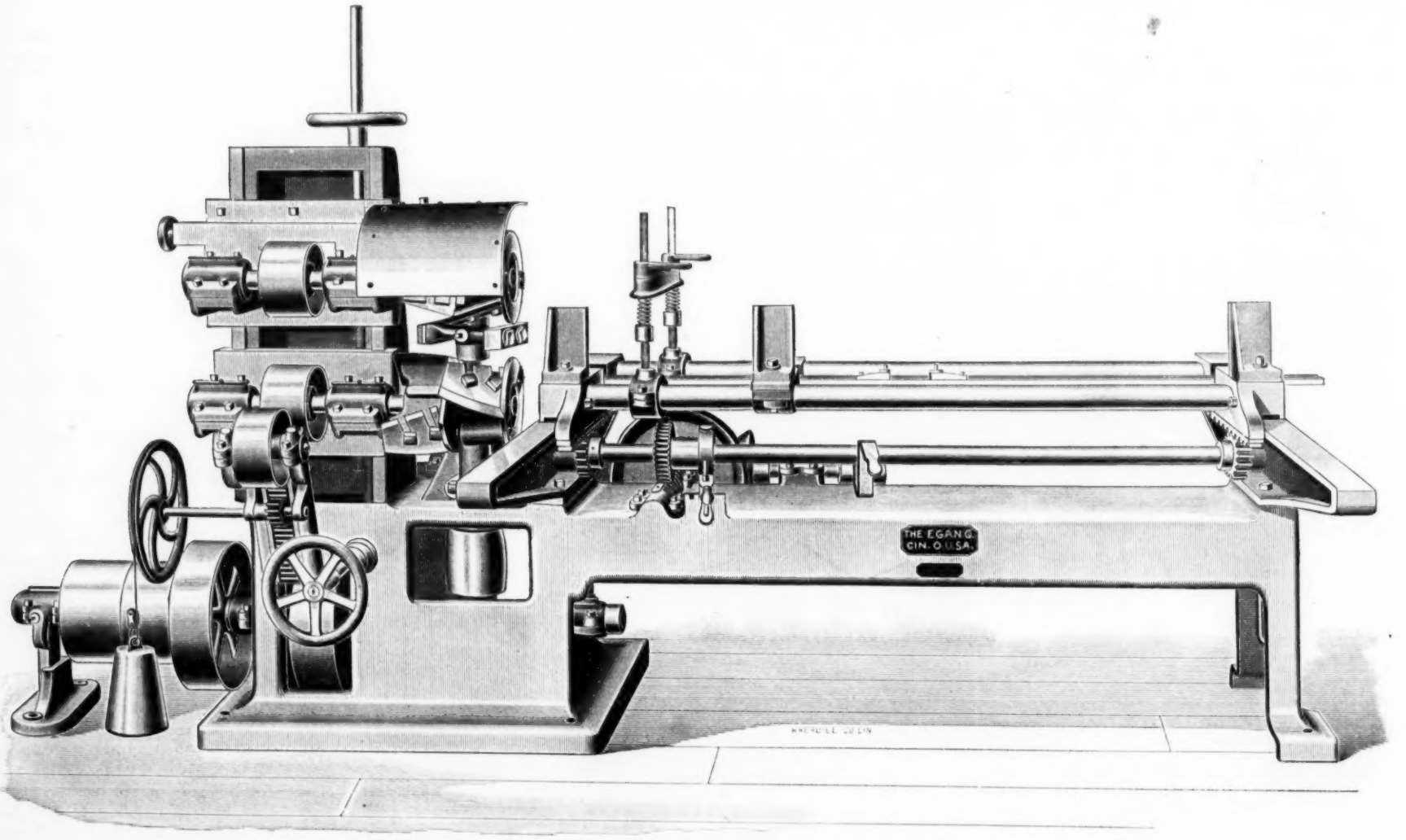
Heavy, Car-Timber Tenoning Machine.

The illustration is of a machine recently brought out by The Egan Co., of Cincinnati, Ohio, which is designed for cutting single or double tenons on large timbers, such as are used by car or bridge builders. The frame of the machine consists of a heavy hollow column and base, to which is bolted, on planed surfaces, the extension which supports the table, moving on planed ways and given its movement by a rack and pinion at each end, thus causing it to move parallel, and relieving the ways on which it moves of any undue friction. The friction cones driving the pinions are large in diameter and so arranged that the table returns at about twice the speed at which it goes forward to the cut. The movement of the table is controlled by a lever, and the pressure applied governs its travel according to the width of tenon to be cut. The center support is adjustable for long or short stock, gage rods being furnished to regulate the length of the tenon, and suitable devices for holding the stock in position while being cut. The mandrels are of steel, of large diameter, run in long self-oiling boxes, with the pulleys placed between them, and a belt tightener is provided for giving the cutter heads ample power when making a heavy cut.

Timbers up to 14 inches square can be worked on the machine, which, when fitted with double heads, will cut tenons up to 12 inches long, or with single heads up to 6 inches, and, when fitted with the upright spindle, double tenons up to 4 inches.

Suitable locking devices are arranged for keeping the slides which carry the mandrels from working out of line, and a separate slide, with an extra plate, is provided for adjusting the upper mandrel laterally.

The upright mandrel, for cutting double tenons, runs in self-oiling boxes of ample size and length, and is so constructed that the head can be taken off when it is desired to cut single tenons. The machines are made with or without this upright mandrel.



Car-Timber Tenoning Machine.

Arrangement for Driving Lathes.

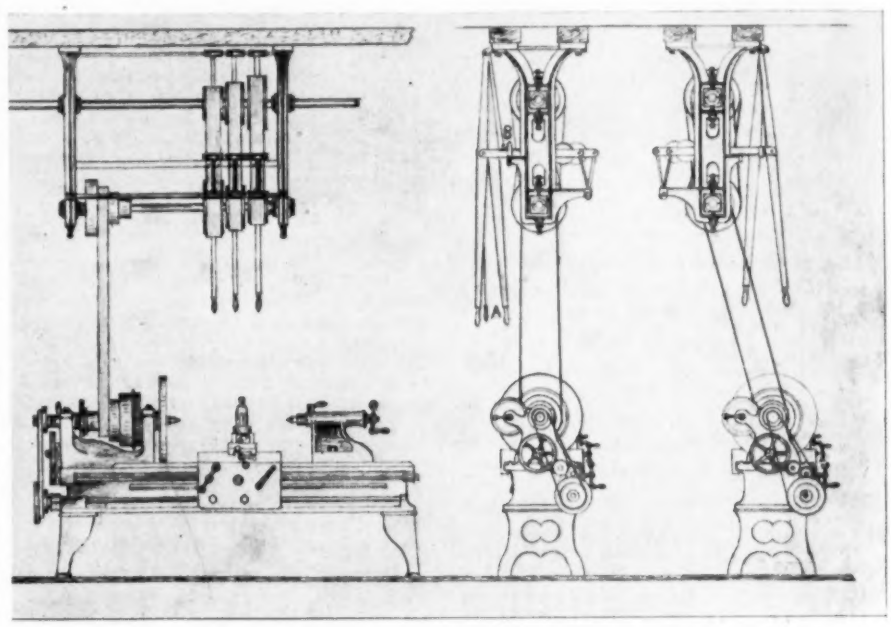
On this page we give an illustration of a method of arranging the power transmission for lathes in a machine shop proposed by The Crafts Machine and Tool Company, Buffalo, N. Y.

The upper shaft in the engraving is a line shaft, which is supported in bearings above others that support the countershaft in the same hangers. The upper shaft can, of course, be as long as desired, and the lathes can be arranged in a row under it as close together as desired, or as circumstances will permit. These lines of lathes can then be placed as close together as desired, as shown by the end view at the right, and may be turned face to face, so that a single overhead rail carrying a hoist will serve two lines; no horizontal overhead belts interfering with it.

On the line shaft, over each tool, a group of pulleys is placed with a corresponding group below, as shown. Each pair of these pulleys is provided with an endless belt, made long enough so that when allowed to hang loosely it will clear the lower pulley, and each fitted with an independent tightener, so that any belt can be thrown into action. The tightener pulleys are supported upon bars that are moved by the levers seen extending below, and a pawl to each bar holds it in any required position for the desired belt tension. The cord *A* is connected to a lifter that disengages any pawl that may be in action, and the corresponding belt is released. Where the ceilings are low the line shaft can as well be in the lower boxes, and the countershaft above, and where it is desired to reverse the motion of the lathes, this is provided for by a special arrangement.

Of course, with other tools, and to some extent with lathes also, they need not be placed directly under the line shaft, but the belt can be led off at an angle if desired.

As shown, the lathes are arranged for a greater range of or for intermediate speeds, but when new lathes are put in it is the intention to have but one pulley in place of the usual cone pulley on the spindle, and make changes of speed by the special attachment shown.



Arrangement for Driving Tools.

Builders of the Light Draught Gunboats.

Secretary Herbert has taken under consideration the report of the Board of Naval Bureau Chiefs, on the proposals submitted for building six light-draught gunboats. The Board recommends the award of two twin-screw boats to the Detroit Dry Dock Co., and one single-screw boat to the Union Iron Works, of San Francisco. The remaining three single-screw boats are to be awarded, one to the Bath Iron Works, of Maine, one to Lewis Nixon, of Elizabeth, N. J., and one to John Dialogue & Son, of Camden, N. J., provided they amend their plans to comply with the Department's requirements.

The objection to the Detroit Dry Dock

Company, which was first mentioned—an ancient treaty, the result of our war with England in 1812, which specified that this country shall not build war ships on the great lakes—was anticipated by that company, and it is their intention, in the event that they secure the contract, to have the machinery made in Detroit, from which point it will be shipped to Seattle, and at the latter place the work of construction will be carried on. A. F. Tennille.

Notes on the Fair of the Massachusetts Charitable Mechanic Association, Boston.

The above-mentioned fair, which is now in its second week, is generally acknowledged by all who have so far seen it, to be the finest ever held by the association, and does credit both to the management and to the exhibitors. The display is so great and varied in its character that to attempt to particularize it would require more space than can be devoted to it, and as the readers of the American Machinist are naturally more interested in matters which relate more particularly to machinery and tools, I have taken note of the exhibits of this class, with one or two other matters which I think will also interest them. For the general description of the fair I recommend them to the newspapers, and would also advise those who can pay a personal visit to it to do so by all means, as they will be more than repaid for the expense in the information to be obtained in their own particular lines, to say nothing of the opportunity afforded of examining and comparing similar machines of different makes.

Entering Exhibition Hall from the main entrance of the building, the first exhibit to attract the attention of the mechanic is the very fine display made by the Walworth Mfg. Co., of Boston; they have erected a stand just to the right of the big electric fountain, consisting of a raised platform with a handsome glass showcase of large dimensions standing in the center, wherein is displayed an attractive collection of some of their products. One of the chief specialties of theirs is valves, of which they show a large number, varying in size from the small brass valve of ⅛ inch up to the large 22-inch Walworth high-pressure tongue and grooved-flanged valve, the last-named being their latest production in this line. Another specialty of theirs, of which they show specimens, is an improved system of pipe bending, by means of which they can bend pipes from ¼ inch up to 20 inches diameter to any curve or right angle. Until within the past year this work has not been done in New England, which fact kept down the use of such pipes in that section on account of expense. The Walworth Co., through fitting themselves out for this class of work, have created a large demand for bent pipes, which are so generally superseding elbows in the piping of the best steam plants. The Hall tapping machine is also shown, which is used for tapping gas or water mains under pressure, and which is a most effective and well-constructed piece of work. The Hall cast-iron pipe cutter here shown is another tool well worthy of inspection; it will cut pipe of heavy cast-iron all the way from 4 inches to 24 inches diameter, and with a minimum of waste through bad breakages so common with the old style of cutting pipe of this size. They exhibit also the "Walworth Automatic Link Sprinkler," of which they show several styles and sizes; this sprinkler is too well known to require much of a description; it is in use all over the country, and never fails in its duty when occasion requires it to act. The exhibit includes nothing not made by the company named, but, of course, does not include nearly all their lines of manufacture. They are represented at the exhibit by Mr. Geo. E. Pickering.

Another fine display is that of A. J. Wilkinson & Co., of Boston. Their stand covers a large space, which is inclosed on all sides, and inside of which inclosure they are showing a number of machines in motion, besides a number of glass cases, containing all varieties of finished hardware, which will be changed from time to time during the fair; they also show a large assortment of machinists' and jewelers' supplies, electrical apparatus, etc. They are showing two new machines, both in operation; one of these is a nut-tapping machine of ingenious construction; it can be fed by a boy, by hand, and is able to tap about 150 per minute; the other is an automatic screw machine, which performs four operations at once, from feeding the stock to cutting off the finished screw. It will make from round stock up to ½ inch, and square stock up to ⅜ inch; they have a variety of other interesting matter to see, which, however, is not directly in our way, so I leave this.

The Boston Gear Works have a representative exhibit of their various styles of gears which is very interesting; they show wheels from the smallest brass gear up to a 30-inch iron gear; they have their stand on the same floor as the two previous mentioned concerns.

The Hendey Machine Co., of Torrington, Conn., have, as might be expected, a very attractive exhibit of their well-known machines, which is located in the basement of the Grand Hall; the "Hendey-Norton" lathes, of which they have five in operation, ranging from 12 to 20 inches. They are naturally attracting a good deal of attention, and when a visitor who understands such things sees them, he usually grows enthusiastic about them, and doubtless feels like ordering one right off. That at least was the experience of a gentleman from Canada, who was looking at them the other day, and I believe he will have it yet, though he has a stumbling block in the shape of the Canadian Tariff to first get over. The rest of the Hendey exhibit comprises three pillar shapers, 15 to 25 inches, and two planers, one 10″–10″–24″, the other 16″–16″–48″.

The Lodge & Davis Machine Tool Co., of Cincinnati, Ohio, through their agents, Chandler & Farquhar, of Boston, are showing an excellent assortment of their manufactures; they are located in the basement of the Grand Hall, as are all other exhibits comprising heavy machinery; the machines are not, at this writing, in operation, but will be so in a day or two. They are showing one of their latest style lathes, 20 inches by 8 feet, and they have also a lathe 16″–8 feet, and a tool-room lathe 16″–6 feet. A 15-inch Fox Monitor lathe is also shown; in drills they are showing a 36 inch combination radial and upright drill, a 28-inch automatic stop drill, a 25-inch drill, two Barnes drills, one a 20-inch and the other a 21-inch back gear and power feed. They have also a No. 3 universal milling machine, a 16-inch shaper, a 24-inch planer, and a 1½-inch bolt machine.

The Norton Emery Wheel Co. are making a fine exhibit in conjunction with Chandler & Farquhar, their Boston agents; amongst their exhibits is the Walker universal cutter and tool grinder, which is well known to readers of the Machinist; this machine can be seen in operation. They have also in operation an improved floor grinder; a peculiar feature of this machine is in having dressers attached for truing up the wheels, which is a very good point. One of this concern's No. 5 grinders is also to be seen in operation, and this they have placed in position and keep running for the accommodation of other exhibitors who may require the services of such a tool. They are also showing a large assortment of oil stones and slip stones in all shapes and sizes for sharpening every kind of tool. One other interesting feature of their exhibit is a collection of specimens of the emery used in the manufacture of the wheels, and here can be seen the different processes of manufacture, from the ore to the finished wheel. The exhibit of this firm should not be missed by the visitor who is interested in such matters.

Another exhibit located in the basement of the Grand Hall will particularly attract the notice of all machinists and other interested parties likely to visit the fair. This is an entirely new style lathe called the "Childs' Automatic Rapid Lathe," built by the Blanchard Machine Co., of Boston. It is attracting a vast amount of attention, and has pleased everyone who has examined it. While not being quite so handsome a machine as a variety of other makes it possesses features of its own which at once commend it to all who know what a lathe is; it has many admirable qualities of which we may be able to give an account later.

The American Tool and Machine Co., of Hyde Park, Mass., have a pretty good exhibit of several of their specialties comprising sugar machinery, a patent spring needle circular knitting machine, pulleys, hangers and shafting and a patent belt tightener; this latter seems an excellent device and can be seen in operation attached to the driving power of the engines belonging to the association.

The Deane Steam Pump Co., of Holyoke, Mass., have a representative exhibit of the various styles of these well-known pumps, and they show different sizes from one of a capacity of four gallons per minute to their large pump of a 1,400-gallon per minute capacity. They also show one of their patent artesian engines, which is well worth inspection.

The Niles Tool Works Co., of Hamilton, Ohio, have an exhibit of two of their machines, one a 37-inch boring-mill, and the other their new vertical milling machine, which was described and illustrated in the American Machinist of August 29th last, and which will hardly require further description. The driving power for this last-mentioned machine is applied by means of a 25 horse-power regular street-car motor made by the General Electric Co., the motor being connected directly to the countershaft.

The Gisholt Machine Co., of Madison, Wis., have two machines on view, of which one is their standard 24-inch swing turret lathe. The other machine shown by them is their universal tool grinder, which has been the subject of an illustrated article in these columns, and is well known.

Westinghouse, Church, Kerr & Co., engineers, of New York, have a fine specimen of a large engine which is being utilized to furnish the steam power for the whole of the exhibition; it is a 260 horse-power compound engine with cylinders 16″–27″, and a stroke of 16 inches.

Kellog & Witherbee, of Boston, have two large engines running, one a "Woodbury" of 100 horse-power, the other a "Philadelphia Corliss" of 150 horse-power; they also show a Marsh steam pump with a capacity of 800 gallons per minute, which is made by the Battle Creek Pump Co; this pump supplies the large fountain in Exhibition Hall.

The Morse Engine Co., of Boston, are showing a 75 horse-power Morse rotary engine which is running a Fort Wayne dynamo of 200 amperes, or 400 lights, and are supplying a portion of the electric lights used in the building.

Holt, Shattuck & Co., of Boston, manufacturers of engines, boilers, pulleys, woodworking machinery, etc., are showing several of their smaller-sized engines, one, a 3 horse-power high-speed, combined, vertical, automatic engine and boiler, which they call the "Climax;" this combination they make up to 16 horse-power. They show also a 12 horse-power high-speed, horizontal, automatic engine, also called the Climax, a 2 horse-power vertical yacht engine, two band saws and two circular saws. Another portion of their display and one well worth seeing is a series of the L. & D. wood pulleys, which are of a different construction to the old-style split pulley, and are considered to be very much superior.

S. L. Holt & Co., of Boston, have an exhibit of engines comprising the following: A 30 horse-power portable engine and boiler built by the Steam Engineering Co., of Watertown, N. Y.; a 70 horse-power automatic engine, and a 60 horse-power of the same style; they have also a small 6 horse-power return flue portable engine. All the above are single cylinder.

The H. N. Bates Machine Co., of Boston, have a very fine exhibit of engines built by the Erie City Iron Works, Erie City, Pa., comprising a high-speed automatic cut-off engine, which is especially designed for electric light and power plants; a "Tangye" bed automatic cut-off engine, designed for mills and electric light and power plants where medium speed with close regulation and economy of steam are required, and a class "C. C." automatic cut-off engine for electric light and power stations in mills, etc., where the service is constant; a class "D" engine, a portable engine and boiler, a class "D" engine and portable boiler, and an under-mounted portable engine; in addition to the foregoing they are showing a fine 200 horse-power Corliss type engine, also a complete line of portable boilers, hangers, pulleys and shafting.

The John A. White Co., of Dover, N. H., have a very complete exhibit of woodworking machines, built by themselves, amongst which the following may be seen in operation, a re-sawing machine capable of re-splitting stock 24 inches wide and 10 inches thick, the maximum rate of feed being 40 feet a minute; a Dover planer with 26-inch knife, and a bed drop of 10 inches; a 16-inch lathe using the Gordon variable speed pulley, a 36-inch band saw, a Gordon No. 2 saw bench, a newly improved 16-inch buzz planer, and in addition to the foregoing there are 12 other machines shown comprising various other types of woodworking machines.

The Chase Turbine Mfg. Co., of Orange, Mass., have a good exhibit of machines used in the saw-mill. They show amongst others a patent thumb-hole machine for cutting out the thumb holes in box lids, a groover for grooving lids of lock corner boxes. These two machines are perfectly new and have not been exhibited before. They also show a lath machine and bolter which cuts four laths at once, a 24-inch timber planer with improved reversible motion for raising or lowering the bed, a fan blower, a turbine wheel and a shingle-cutting machine. This concern are also manufacturers of the bulk-head gate hoistings, which can be operated by either hand or power, they show a large photograph of 12 sets of gate hoistings which they furnished for the Pejepscot Paper Co., of Pejepscot, Me., and which can be operated either all at once or singly.

The J. M. Marston & Co., of Boston, are showing a variety of hand and foot-power woodworking machines which are well worth an examination; they make a special line of this class of machines.

The New England Turbine and Fuel Co., of Boston, have a striking exhibit of a 15 horse-power Altham steam turbine engine, which is running 100 16 candle-power incandescent lights. The engine is capable of running 150 lights, and the exhibitors claim that with 100 pounds pressure of dry steam they could furnish 300 lights of the same power from the same engine.

Rawson & Morrison, of Cambridgeport, Mass., have a very good exhibit of coal-hoisting engines and machinery, of which they make a specialty. They are showing a 30 horse-power high-speed engine and boiler, designed especially for coal-hoisting work. This has one 7½-inch cylinder, 12-inch

stroke. They also show an improved "Boston" hoisting engine and boiler with double drum, 15 horse-power, 5½-inch cylinder, 10 inches stroke; a ship's hoisting and trolley engine, 15 horse-power, 5½-inch cylinder, 10 inches stroke; a friction drum; a Rawson & Morrison automatic steam coal shovel, with a capacity of from 1,500 to 6,000 pounds, and a working model of the Rawson & Morrison incline for discharging coal from vessels. This has a capacity of from 80 to 120 tons per hour.

J. A. W.

Preliminary Trial of the "Indiana."

The new battleship "Indiana" was given a preliminary trial run on the 16th, and acquitted herself very creditably, attaining a speed of 15.31 knots. The vessel showed herself to be unusually free from vibration and very steady.

The engines ran at an average speed of 128 revolutions, and a maximum of 131, and with 1-inch forced draught and steam at 159 pounds pressure developed 9,200 horse-power, which was 200 more than the requirement.

Machinery on the Jerome Park Reservoir.

The contract for the construction of the Jerome Park Reservoir, New York, was awarded to Mr. J. B. McDonald, at $5,473,060. It involves the removal of upwards of 3,000,000 cubic yards of rock.

The contractor has, since the letting of the work, made a thorough investigation looking to a determination of the question whether or not machinery for excavation can best be run by steam, or from a central compressed air plant. The central plant system has been adopted as the best and cheapest, the saving in expense being largely in labor and fuel.

The plant made by the Ingersoll-Sergeant Drill Co., and adopted by the contractor, involves the use of compound condensing Corliss air compressors, run by high class boilers, transmitting and distributing compressed air at 80 pounds pressure throughout the work.

It is contemplated to use a battery of several air compressors placed side by side, the unit adopted being a duplex compressor with steam cylinders 24 inches and 44 inches in diameter, stroke 48 inches, driving two piston inlet air cylinders, each 24½ inches in diameter by 48-inch stroke. The capacity in free air of this machine being between 3,000 and 4,000 cubic feet per minute. This is a duplicate of compressor at work at the Anaconda mines in Montana, where very economical results have been obtained.

If you feel within yourself a desire to expand your usefulness in behalf of the machine interest of this country, if you are a bright, aggressive man who can tell his story to advantage and address business men; in short, if you think it possible to earn more money, write or call on the Treasurer of the American Machinist and he will show and explain a method which might make you a more useful man and add largely to your income.

NEW CATALOGS.

There are three sizes of Standard Catalogs, 9" × 12", 6" × 9" and 4½" × 6". We recommend the 6" × 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

The L. S. Starrett Co., Athol, Mass., issue a diminutive little pamphlet illustrating forms of milling machine cutters made by them. It is 4⅛" x3".

Benjamin F. Kelley & Sons, 91 Liberty street, New York, send us a pamphlet devoted to the illustration and description of the Standard feed-water heater, which is declared to be different from all others and to possess unique virtues.

Holt, Shattuck & Co., Boston, Mass., send us a catalog illustrating and describing the "L. & D." wood pulley. Engravings show just how the pulley is constructed, and how it is applied to shafting, and the pamphlet will be found interesting to those who have to do with power transmission. It is 3⅝"x6".

The American Wrapping Machine Co., of Dayton, Ohio, send us a pamphlet illustrating and describing their machine for wrapping papers and pamphlets; it is stated that the machine will wrap a pamplets, of from 4 to 75 sheets in thickness of any size, will put any width of wrapper on, and wraps from 1,800 to 2,500 an hour.

We have received from the Decker Cycle Co., 25 Union street, Worcester, Mass., an illustrated catalog of the Decker bicycle. Details of construction, showing method of joining the frame, arrangement of bearings, etc., are given, and the catalog will be found interesting to those who ride or have to do with the construction of bicycles. It is 6⅝" x4".

The Standard Machine Co., Lebanon, Pa., send us a pamphlet illustrating and describing a line of bench grinding machines of the standard type, that is, with a spindle designed to hold an emery wheel at each end with the usual rests, etc. The same machines are also put upon a hollow column having a base for standing upon the floor if so desired.

The new catalog of the Brown & Sharpe Mfg. Co., to which we have previously referred, has in it a complete list of worm hobs that are on hand at the factory, and are therefore available for use in hobbing worm gears. Attention is called to the fact that machine designers and others may by consulting this list adapt their worm gearing to some hob already made, and thus save the expense of a new one, which expense may range from $10 to $125.

MANUFACTURES

G. S. Coffin will shortly build a cotton-mill at Woodruff, S. C.

The Bryant Paper Co., of Otsego, Mich., has been organized with a capital of $125,000.

C. H. Remington & Co., of Carthage, N. Y., will shortly erect a large pulp and paper-mill.

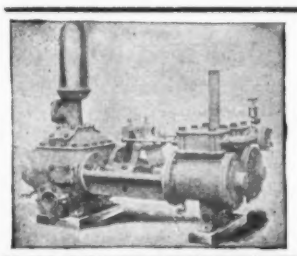
The Marlboro Mill Co., of Bennetsville, S. C., will erect a cotton, rope and twine mill.

J. F. Seiberling and others of Akron, Ohio, have formed a company to manufacture bicycles.

The Torrington Chain Co. has been organized at Meriden, Conn., to manufacture bicycle chains.

The Monett (Mo.) Milling Co. has been formed by D. B. Kengary and others with a capital of $35,000.

The Warren (R. I.) Mfg. Co., which was recently destroyed by fire, will shortly be rebuilt at a cost of $1,000,000.



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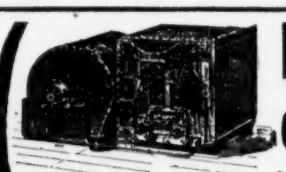

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ARE SUPERIOR TO LATHES FOR FACE PLATE WORK.
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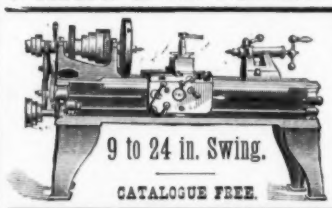

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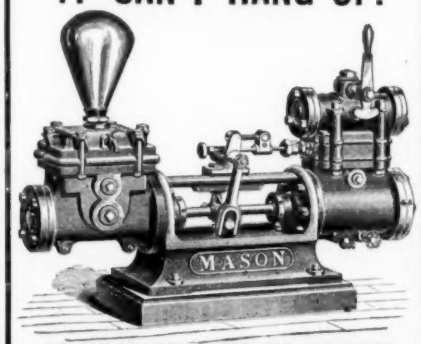

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By JOHN J. FLATHER, Ph. B., M. M. E.,
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We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.
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87 Maiden Lane, NEW YORK.

E. C. Potter and others have incorporated the Potter & Hollis Foundry Co. at Chicago, Ill., with $10,000 capital.

The Chicago (Ill.) Pressed Steel Co. has been organized by James W. Wilson and others with a capital of $500,000.

The Brownville Paper Co., of Carthage, N. Y., propose to erect another large pulp and paper-mill at a cost of $150,000.

The Turner Tobacco Granulating Machine Co., of Roanoke, Va., has lately been organized by Geo. A. Turner and Wm. J. Wright.

The Continental Cycle Co. was recently formed at Chicago, Ill., by W. Irving Osborne and others with a capital of $50,000.

Geo. J. Fritz Foundry and Machine Co., of St. Louis, Mo., has been organized with a capital of $35,000 by M. Fritz and others

The Prosperity (S. C.) Cotton Mill has been formed recently and have elected Y. E. Hawkins president, and A. H. Kohn secretary.

The Phillips Mfg. Co. are organizing a manufactory at 307-309 West Broadway, N. Y. City. They will manufacture the Phillips bicycle.

Geo. W. Faulk and others have formed the Faulk-Craft Lumber Co., at Leaksville, Miss., with a capital stock of $40,000, and are erecting a large saw-mill.

The Texas Briquette and Coal Co., of San Antonio, Texas, has been incorporated with a capital stock of $100,000, to manufacture fuel out of ignite. L. S. Berg is among the incorporators.

The business of the Taylor-Rice Engineering Co., of Wilmington, Del., will be removed about the first of November to Gloucester City, N. J., having absorbed the boat building of Clay & Torbensen.

The estate of C. W. Le Count, South Norwalk, Conn., has been settled, and the business sold to Mr. Wm. G. Le Count, a son of the late C. W. Le Count, and it will be continued by him at the old address, and we believe on the same general lines.

The Arthur Co., formerly of John street, have removed their works to 188-190 Front street, New York. They have made many improvements in their works and have increased their facilities in pattern-making, blacksmith work, machine work, lathe work, milling, gear cutting, brass work, etc.

Messrs Goeppen & Brown, formerly connected with the Ahrens & Ott Mfg. Co., of Louisville, Ky., will engage in the manufacture of plumbers' supplies and brass specialties in the same city under the firm style of the Enterprise Brass Works. They are now getting their buildings in shape and have ordered their complete outfit of tools from The Lodge & Davis Machine Tool Co., of Cincinnati, Ohio. They expect to be ready for operation within the course of 30 days.

Messrs. F. J. Werneth & Co., 806 Druid Hill avenue, Baltimore, Md., are making an attachment to assist in learning to ride the bicycle. It consists of two small wheels, one of which is placed either side of the rear wheel, and these small wheels can be adjusted vertically so as to be quite near the floor or at some distance from it, and they are designed to prevent the wheel from falling over. It is claimed that they give a beginner increased confidence, and that they should be used in all cycling schools especially.

Grant Sipp recently bought from G. E. Wright, Newark, N. J., all tools and machinery for the manufacture of small stationary and marine engines and boilers, and located this business in Mill street, Paterson, N. J. The shop is well equipped for the manufacture of small engines of all kinds with cylinders 1 inch diameter and upward, and for furnishing half-finished sets of engine castings; also for making suitable boilers for these small engines, and special tools and jigs for manufacturers.

Washington, D. C., Oct. 12, 1895.—The Corbett Mill and Machine Co., a corporation incorporated under the laws of West Virginia, manufacturers of machinery and engines, doing business at 487 Missouri avenue, northwest, made an assignment October 12th to Bates Warren. The assets are estimated at $14,676.95 and the liabilities amount to $17,585.30. Decline in trade and inability to collect money due are given as a reason for the failure; 81 creditors are named in the schedule of liabilities, of which the following are the principal ones: Norrish Foundry and Machine Co., $6,247.30, holding five notes to the amount of $4,938.26 as part security; Maish & Gorton Mfg. Co., Warsaw, Ind., $1,749.55; South Bend Pulley Co., South Benn, Ind., $612.40; J. C. Rhoads & Son, Wilmington, Del., $947.69; Main Belt Co., Philadelphia, Pa., $466.95; N. J. Car Spring and Rubber Co., Jersey City, N. J., $456.95; J. H. Ernst & Co., New York, N. Y., $687, and Struthers, Wells & Co., Warren, Pa., $847.33.

Machinists' Supplies and Iron.

New York, October 19, 1895.

Iron—American Pig—We quote standard Northern brands, $14 to $14.50 for No. 1; $13 to $13.50 for No. 2; $12.75 to $13.25 for No. 2 Plain, and $12.50 to $13 for Gray Forge. Southern brands, $14 for No. 1; $13.50 to $13.75 for No. 2; $13 to $13.50 for No. 3; $13.50 to $14 for No. 1 soft; $13 to $13.50 for No. 2 soft; and $12.50 to $12.75 for Foundry No. 4.

Antimony—The market is quiet. Cookson's is quoted at 8c. to 8½c.; Hallett's at 7¼c., and Japanese at 6¾c.

Lard Oil—Prime City is quoted at 50c. to 51c.

Copper—There is not much change in the market. Lake Copper is quoted at 12c., which buyers are not willing to give. A sale at 11.85c., prompt delivery, is reported. Casting Copper is irregular, the price varies from 11¼c. to 11⅝c., according to quality. Only a moderate business has been transacted.

Lead—The market is active and transactions at 3.35c. are reported, and in some instances sales were made at 3.37½c. to 3.40c.

Spelter—The market remains dull and weak. For New York delivery 4.20c. is quoted for good Western brands.

The market is firm and active, with transactions at 14.60c. for deliveries up to December.

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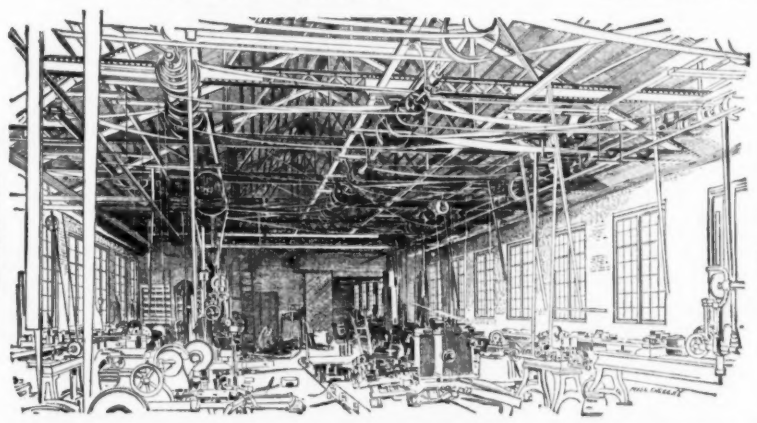

Iron and Steel Bridges and Buildings.

The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for The C. W. Hunt Co., at West New Brighton, Staten Island, New York. The building is 42 feet in width by 202 feet in length, and is used by the C.W. Hunt Co. as a Machine Shop. The side walls are of brick and the roof trusses of iron, with iron purlins covered with slate, so that no wood work is used about the construction of the building in any way, shape or manner, thus eliminating entirely the danger from fire. This is one of the best designed and equipped Machine Shops of its size in the United States.

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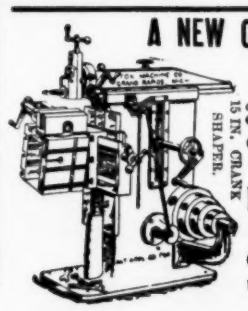

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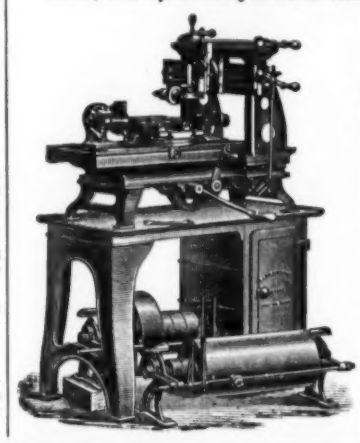

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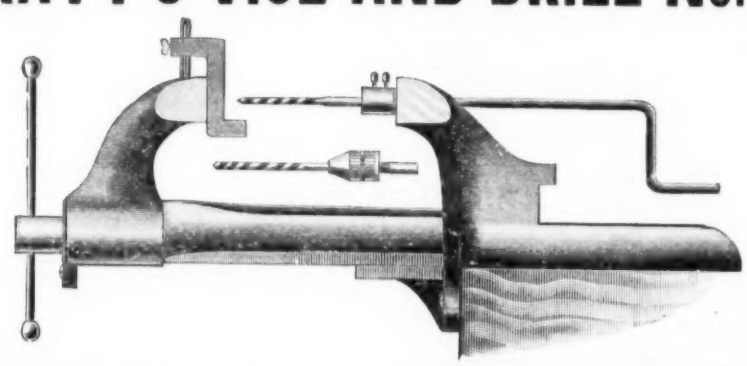
184 Washington Street, Boston, Mass.

PRATT'S VISE AND DRILL No. 2.



This is a 4-inch Vise with Steel Jaws and Drilling Attachment as seen in the cut. The drill socket fits a half-inch drill shank and also the shank of the drill chuck which goes with the machine, so that holes may be drilled from ⅛ to 1 inch in diameter. The drilling attachment may be removed by loosening one set-screw. For nearly all kinds of work this is one of the best drills in use, and we are selling the whole thing, including the chuck, at about the same price which we formerly charged for the vise alone. We warrant this tool to give perfect satisfaction.

Width of Jaw, 4 inches. Weight, 50 pounds. Opens, 11 inches. Height of Jaw, 5⅛ inches.
Price of Vise and Drill, including chuck, $7.00.

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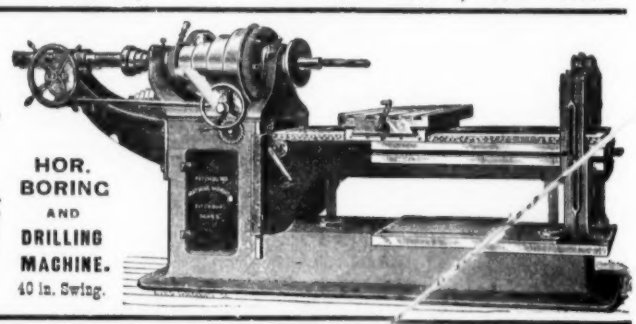

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WATER WORKS.
SIMPLE, COMPOUND, OR TRIPLE EXPANSION,
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WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Wanted—Bright, active machinists to canvass for subscription to AMERICAN MACHINIST, liberal commission. Address, with refs., Subscription Dep't, AMERICAN MACHINIST, 203 Broadway, N. Y.

Wanted—Mechanical draftsman, with shop exp.; apply at once. C. & C. Elec. Co., Garwood, N. J.

Wanted—Pos. by draftsman; technical graduate, with shop experience. W. M. C., AM. MACHINIST.

1st-class draftsman, lately arrived, techn'l education, desires situa'n; salary moder'e. Box 145, A. M.

Draftsman with shop and office experience and technical education wants pos. O. M., AM. MACH.

Draftsman, mechanical, general machinery and pumps; A1 refs. Box 139, AMERICAN MACHINIST.

Wanted—A few reliable agents to sell my calipers on commission. E. G. Smith, Columbia, Pa.

Agradua te of technical school wants position in mechanical or electrical engineering; not afraid of work. Address Box 5, Bluff Springs, Illinois.

Competent designer of experimental machinery, wants pos.; 10 yrs. exp., references, technical education, reasonable terms. Box 147, AM. MACHINIST.

Mechanical draftsman, age 23, technical graduate, with 3 years' office and shop experience, wants position. Box 146, AMERICAN MACHINIST.

Foreman for mach. shop—15 to 20 men—medium weight mach'y and general jobbing; chance for right man to grow; state experience, and wages expected. Connecticut, care AM. MACHINIST.

First class engineer and machinist wants to take charge of motive power and repair departments in large factory; 12 years' experience. Mechanic, AMERICAN MACHINIST.

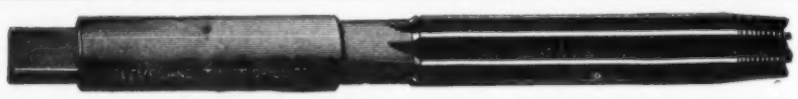
Machinists Wanted—First-class vise, planer and boring-mill men wanted by concern mfg. heavy engines and machinery; good Ohio town; no intemperates nor incompetents need apply. Address stating exp., Box 140, AMERICAN MACHINIST.

Wanted—An experienced and competent salesman, familiar with the twist drill trade; applicants with engineering knowledge will be given preference; mention experience, references, and salary expected. Address Drills, AMERICAN MACHINIST.

Wanted—One or two first-class draftsmen, capable of designing tools and fixtures, and familiar with gun, sewing machine, bicycle and typewriter work; also a few competent die sinkers. F. C. S., Box 141, care AMERICAN MACHINIST.

Wanted—Young man as assistant foreman in machine tool works in Philadelphia; one with good executive ability, lots of push, and capable of

(*Continued on Page* 855.)



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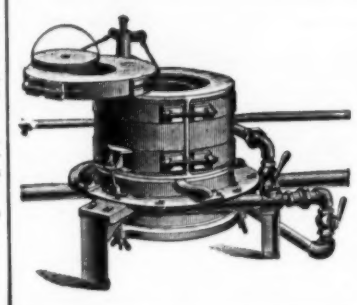

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For the economical generation and systematic application of HEAT.

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we offer our entire stock of machine tools at **SECOND-HAND** prices. This is a **BONA-FIDE** offer and the **OPPORTUNITY** of the **YEAR.**

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SECOND-HAND MACHINERY.

36" Gould & Eberhardt Gear Cutter.
20" Pratt & Whitney Chucking Lathe.
60" Triple-geared New Haven Lathe, with chuck jaws.
40" New Haven Back-geared and Power-feed Drill.
32" Double-head Pond Planer.
No. 1 Giant Key Seater.

Send for complete list. Send for catalogue of Bicycle machinery.

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BEFORE REMOVAL.

At Phœnix Iron Works, Trenton, N. J.

15 in. x 6 ft. Engine Lathe.
22 " x 12 " " "
39 " x 13½ " " "
26 " x 30 " " "
37 " x 30 " " "
71 " x 16 " " "
52 in. x 20 ft. Engine Lathe.
19-36 and 50 in. Drills, Portable Drill.
36 in. x 14 ft. Planer.
12 in. Shaper Traverse Head.
Gear Cutter, 54 in.
Milling Machine.

10 ft.-16 ft. Vertical Boring and Turning Mill, Cranes, Blower, Boiler Rolls, Punch and Shear, etc.

Send for full list and prices.

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2 10 in. x 5 ft. Foot & Power.
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1 16 in. x 8 ft. Flather.
2 18 in. x 8 ft. Flather & Prentice.
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2 21 in. x 10 ft. Pratt & Whitney.
1 27 in. x 10 ft. Dustin.
1 28 in. x 12 ft. Blaisdell.
2 30 in. x 14 ft. Lincoln.
1 32 in. x 13 ft. Bement Triple Geared.
1 22 in. x 10 ft. Niles.
1 24 in. x 10 ft. Niles.
1 79 in. Driving Wheel, Bement.
1 48 in. x 18 ft. Gay & Silver.
1 32 in. x 10 ft. Open Side.
1 60 in. x 60 in. x 22 ft. Hepworth.

DRILLS.

3 22 in. Back Geared.
2 35 in. " & P. F., Snyder.
1 34 in " " " Harris.
2 No. 1½ Niles Radial.
2 Suspension Drills.

MILLING MACHINES.

1 No. 1 B. & Sharpe.
2 No. 3 Garvin.
1 No. 15 "
1 No. 2 " Hand, and others.

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9 in., 12 in., 13 in., 15 in., 20 in.

MISCELLANEOUS.

1 18 in. P. & W. Screw Machine.
1 20 in x 6 ft. Flather "
3 Horiz. B. & D. Machines.
1 Cylinder Borer P. & A.
1 30 in. Motor Gear Lathe
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1 30 in. Pulley Lathe.
1 Hydraulic Riveter.
2 Bolt Cutters.
1 Nut Tapper.
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Also large stock of other tools. Send for List.

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ENGINE LATHES.

Fifield Improved Lathe, 25 x 12 Compound Rest.
15 x 6 Blaisdell, Compound Rest with turret; Hollow Spindle.
14 x 6 Robbins Compound Rest, Hollow Spindle, Power Cro s Feed.
13 x 6 Ames Rise and Fall Rest, Hollow Spindle.
11 x 4 Mann, Hollow Spindle.
16 x 7 Maker Unknown.
16 x 8 Blaisdell, Plain Rest.
18 x 10 Flather's, Plain Rest, Large Hollow Spindle.
18 x 10 Blaisdell, Plain Rest.
28 x 20 Perkins Power Cross Feed.
37 x 14 Maker Unknown.

PLANERS.

16 in. x 16 in. x 3½ ft. Hendey.
20 in. x 20 in. x 4 ft. Nashua.
22 in. x 22 in. x 4 ft. L. W. Pond.

SHAPERS.

10 in. Juengst, Crank.
12 in. Juengst, Crank.
10 in. Wood and Light, Traverse Head.
18 in. Putnam, Traverse Head.
15 in. Juengst Friction Shaper.

HAND LATHES.

1 10 in. x 41 in. Garvin.
1 12 in. x 6 ft. Wright.
1 12 in. x 5 ft. Back Geared.
1 20 in. x 8 ft. " "

MISCELLANEOUS TOOLS.

24 in. Barnes Water Tool Grinder
Garvin Profiler, 1-spindle.
No. 2 National Bolt Cutter.
60 in. Lincoln Gear Cutter.
26 in. Pulley Lathe.
50 in. Pulley Lathe.
5 in. Cutting-off Machine.
No. 2 Springfield Tool Grinder.
No. 1 Garvin Screw Machine.
36 in. Bliss Power Squaring Shear.
No. 2 C. Worcester Drill Grinder.
21 in. Squaring Shear.
14 ft. Power Draw Bench.
225 lb. Gould & Eberhardt Drop Press.
100 lb. Stiles Power Drop Press.
75 lb. Drop Press.
No. 31 Eaton Double-Acting Press.
No. 2 Garvin Wire Spring Coiler.
No 6 35 in. Sturtevant Blower.
No. 2 Norton Grinder, with Two Wheels and Countershaft.
1 Diamond Lapping Attachment.
1 Hanson & Van Vinkle Polishing Stand
1 Springfield No. 2 Water Grinder with Trueing Attachment.

Also, a large list of other machines. Write for complete list, detailed description and prices.

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LAIGHT & CANAL STS., NEW YORK.
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Buildings and Land for light or medium manufacturing, in manufacturing center of a New England city of 100,000 inhabitants.

Price $85,000—a rare bargain

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MODERN STYLE. FIRST-CLASS ORDER.
Will Be Sold Very Low Before Removal.

ENGINE LATHE—Flather, 14 x 6 ft., Hollow Spindle, Cross Feed.
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" " Pratt & Whitney, 16 x 7 ft., Raise and Fall Rest.
" " Putnam, 16 x 8 ft., Raise and Fall Rest.
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" " Pond, 20 in. x 15 ft., Extra Heavy. A 1.
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" " Union, 72 x 20 ft., Triple Geared, Screw Feed.
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" Gould & Eberhardt, 26 in. x 8 ft. A 1.
" Fitchburg, 27 x 8 ft., Automatic Feeds.
" Pond, 32 in. x 8 ft.
" Pond, 36 x 12 ft. A 1 order.
" Betts 36 x 10 ft., Extra Heavy.
" Gray, 48 x 12 ft., "Latest," 2 Heads.
" Betts, 60 x 16 ft., 4 Heads, Extra Heavy. A 1.
" Crank 12 in. stroke. "Pond's."
SHAPER—Gould & Eberhardt 15 in. Crank.
" Prentiss 17 in. Crank. Good as new.
" Hendey 24 in. Friction. Good order
" Pratt & Whitney 14 in. x 60 in., Traveling Head, 2 Tables.
" Fitchburg 14 in. Traveling Head, 28 in. Feed.
DRILL—Prentice 26 in., Friction Pulleys for tapping.
" Blaisdell 28 in., Back Gears.
" Hamilton 28 in., Back Gears. Automatic Feed.
" Pond 32 in. Extra Heavy, Back Gears, Automatic Feed.
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" " Garvin No 3, Power Feed, Vise, etc.
" " Kempsmith, Universal Miller.
" " Lincoln Pattern with Vise.
PROFILING MACHINE—Pratt & Whitney, 2 Spindles, Forming Attachment. A 1.
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" " Niles, 2 in. hole Carriage Feed with Tools.
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" " Gould & Eberhardt, 30 in. Automatic.
" " Gould & Eberhardt, 36 in. Automatic.
" " Hewes & Phillips, 60 in. Semi-Automatic.
PRESSES—Bliss No. 18 and 19.
" Stiles No. 1, 2 and 3.
Horizontal Boring and Drilling Machine Sellers 60 in.
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Boiler Rolls, 10 ft., Improved Style. A 1.
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in first-class order, much of it as good as new.

We have constantly in stock a large selection of such machinery, bought for cash or taken in trade for new tools.

It sells so quickly that it doesn't pay to print a list, but we **may** have the **very machine** you need.

Please tell us what you want. If we have it we'll make the **price right.**

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Modern Metal-Working Machinery FOR SALE.

At the factory of the Lamson Consolidated Store Service Co., Lowell, Mass., may be seen some 70 machines, which, owing to their disposal of the cash register department of their business, they have decided to sell. These tools are all in first-class order and modern, and will be sold at low figures. Your inspection is solicited. A complete list will be furnished on application.

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One New Delamater Duplex Steam Pump, 8 x 5 x 10, brass-lined, 4" suction, 3" discharge; a bargain. Other sizes, new and second-hand. **COOKE & CO., 163 & 165 Washington St., N. Y.**

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FULL THREAD AT ONE CUT
ALL PARTS SUBJECT TO WEAR ARE CASE HARDENED ALL GUIDES OF HARDENED STEEL
ADJUSTABLE DIES
EXACT SIZE IRON AND 1/32D OVER SIZE IRON CUT WITH SAME DIE

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METAL WORKERS' TOOLS AND SUPPLIES
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IN FIRST-CLASS CONDITION.

16 in. F. B. Miles Slotting Machine.
2,400 Pound Miles Steam Hammer, Single Standard.
30 in. by 27 ft. Pratt & Whitney Engine Lathe.
Horizontal or Floor Boring Machine, Pratt & Whitney.
Two (2) 5 ft. Universal Radial Drills.
21 in. x 11 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
19 in. x 8 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
26 in. x 8 ft. Pond Machine Tool Co. Engine Lathe.
19 in. x 12 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
22 in. x 12 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
40 in. Bement Vertical Drilling Machine.
24 in. Pratt & Whitney Vertical Drilling Machine.

GEORGE PLACE MACHINE CO.,
145 Broadway & 86 Liberty St., New York.

FOR SALE BY THE
WESTERN ELECTRIC CO., CHICAGO.

4 Pratt & Whitney No. 1 six-spindle drills with screw attachment for elevating table and doors, for covering spindles at $175 each.

3 Pratt & Whitney four-spindle drills with screw attachment for elevating table and doors, for covering spindles, at $125 each.

1 Pratt & Whitney three-spindle drill with doors for covering spindles, at $100.

BLAKE & JOHNSON, Waterbury, Conn.

BUILDERS OF

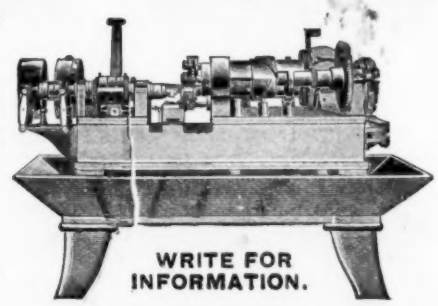
PIN, SAFETY PIN, HOOK AND EYE MACHINERY,

AND LABOR-SAVING MACHINES OF EVERY DESCRIPTION.

Bent Wire Goods a Specialty. Send Samples that we may quote prices for either machine or the Goods.

STEEL BALLS

For all Anti-Friction Purposes.



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AUTOMATIC SCREW MACHINES

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SCREW MACHINE PRODUCT

OF EVERY DESCRIPTION.

Cleveland Machine Screw Co.,
CLEVELAND, OHIO.

WRITE FOR INFORMATION.

turning out the best grade of heavy work; state experience and all particulars. Address Box 144, American Machinist.

Wanted--An intelligent man in every machine shop in New England to utilize his spare time in raising clubs of subscribers for the American Machinist; liberal commission. Address, with references, John A. Walker, N. E. Agent, No. 4 Church Street, Dorchester, Mass.

Wanted—A first-class draftsman. Would prefer one who is a practical machinist and who has had large experience in designing and constructing coal mine equipments, such as hoisting and haulage engines, ventilating fans, revolving and shaker screens, etc.; please state age, reference, experience, and salary expected. Address M. & F. D., care of American Machinist.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

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Wanted--Machinery to build: special, steam, mill, hydraulic. F.C. & A. E. Rowland, New Haven, Conn.

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Wanted—Responsible manufacturing concern with first-class equipment, to make and introduce on royalty a new and standard machine tool; this is worth investigating. Address "Professional," care of American Machinist.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offer.

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MANUFACTURERS OF
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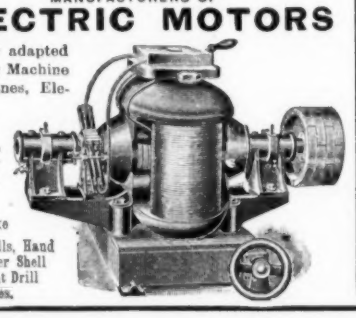
Specially adapted for driving Machine Tools, Cranes, Elevators, Pumps, Presses, and other Machinery.



We also make Portable Drills, Hand Drills, Boiler Shell Drills, Light Drill Presses.

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Iron and Brass Founders and Machinists

PULLEYS of any size, moulded on machine —no pattern needed.

GEARS of any diameter, face and pitch, made on Gear Moulding Machine—no pattern needed.

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SPEIDEL & ROEPER,
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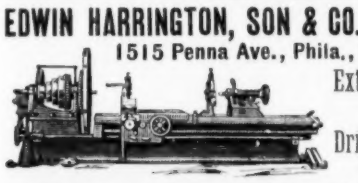

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THE LARGEST AND MOST COMPLETE LINE OF DRAUGHTING ROOM FURNITURE MANUFACTURED BY
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Will preserve a roof for TEN to FIFTEEN YEARS—perhaps longer, without repainting.
Unequaled for SMOKE STACKS, BOILER FRONTS, Etc.

Send for circulars on Paints and Painting.

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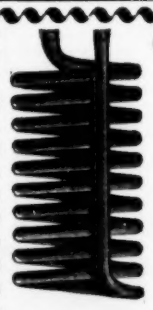

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HORTON CHUCKS,

See to it that our TRADE MARK
"THE HORTON LATHE CHUCK"
Is stamped plainly on their face, all others are IMITATIONS.

THE E. HORTON & SON CO.,
WINDSOR LOCKS, CONN., U. S. A.
Or CHAS. CHURCHILL & CO., 21 Cross St., Finsbury, London, E. C., Eng.

"CUSHMAN" CHUCKS.

For Lathes, Drills, Chucking and Screw Machines, and for Special work.

SEND FOR CATALOGUE.

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CHUCKS The "National."

INDEPENDENT, UNIVERSAL, or COMBINATION.
Est'd 1882. Strongest. Easiest to change. Best finish. **Reversible Jaws** (patented) giving 5 changes including every possible position. Illustrated Catalogue sent. Liberal discounts. Prompt shipment. W. WHITLOCK, 39 Cortlandt St., N. Y.—Works, Hoboken, N.J. McDowell Stocker & Co., Chicago.

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Sweetland Combination Chuck.
Reversible Jaws. Accurate, Standard Independent, Solid Shell, Solid Reversible Jaws, Strong and True.
Send for Catalogue.
The HOGGSON & PETTIS MFG. CO., - New Haven, Conn.

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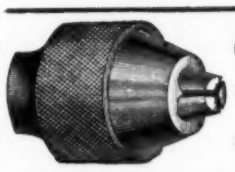
For Reducing and Pointing Wire.
ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
For Machines or Information address the Manufacturer,
S. W. GOODYEAR, Waterbury, Conn.



Almond Drill Chuck.
Sold at all Machinists' Supply Stores.
T. R. ALMOND,
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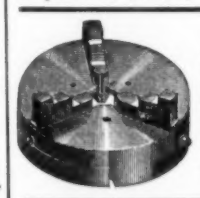

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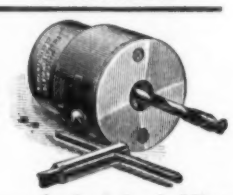

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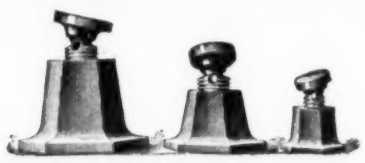

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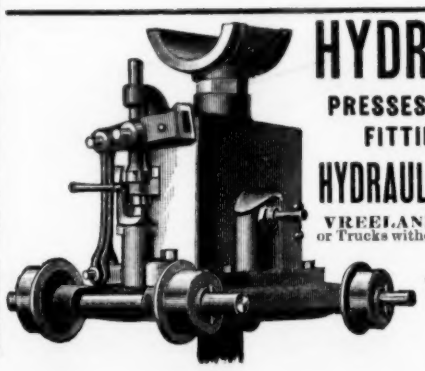

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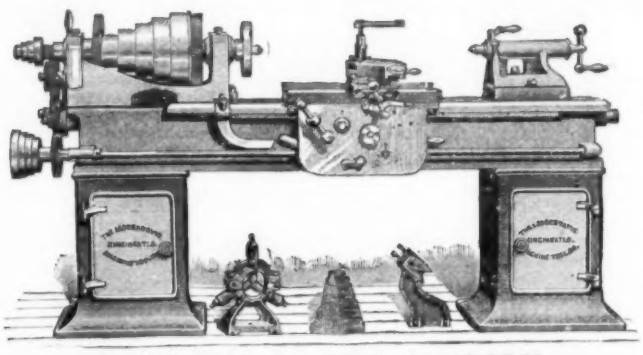

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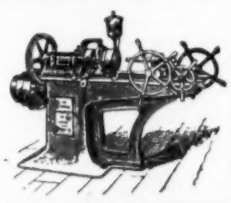

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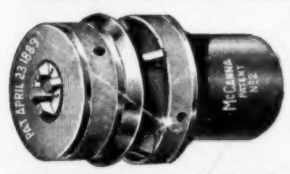

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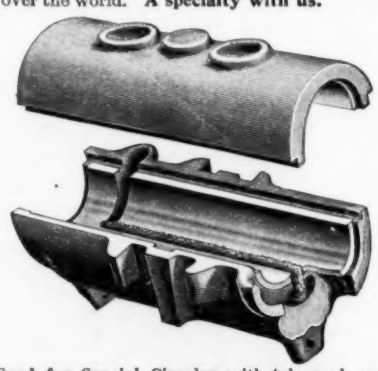

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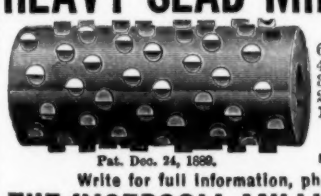

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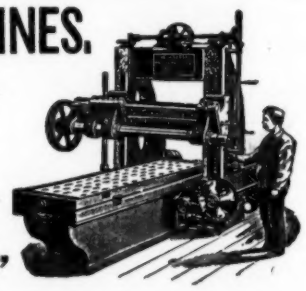

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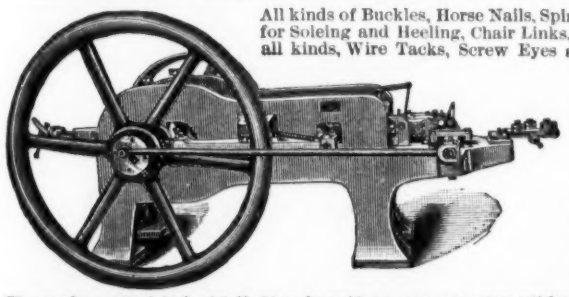

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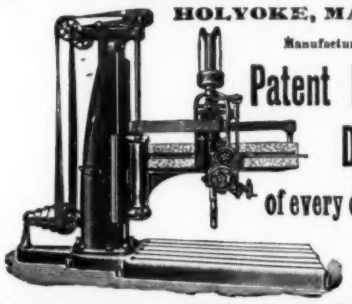

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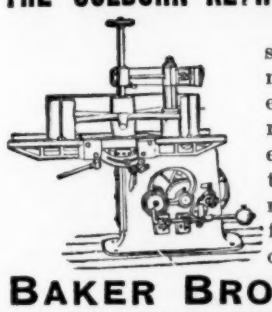

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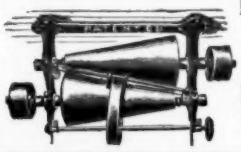

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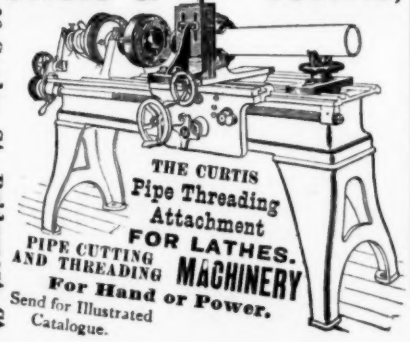

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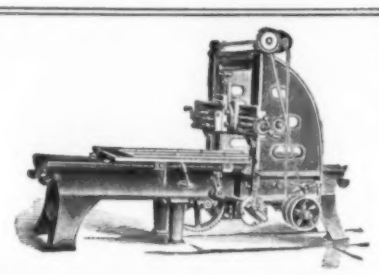

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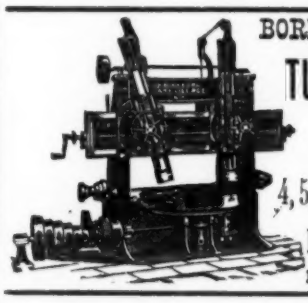

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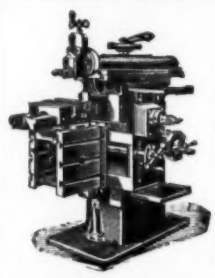

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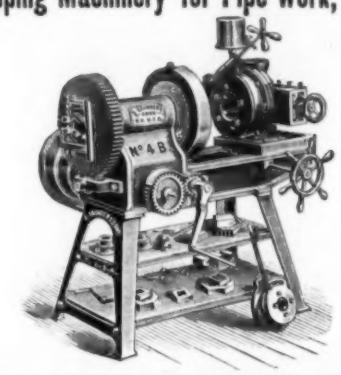

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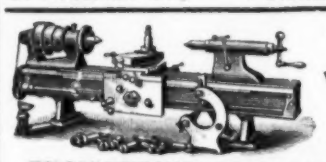

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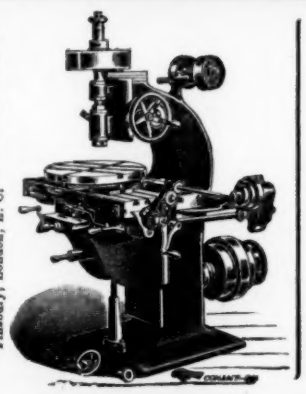

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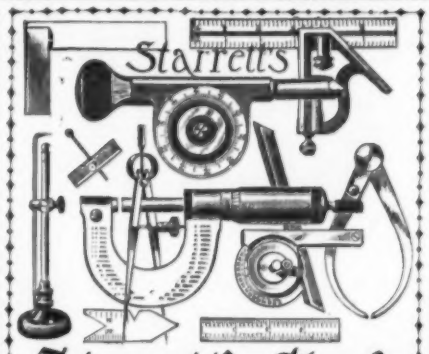

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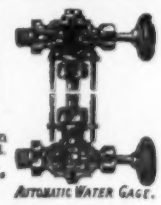

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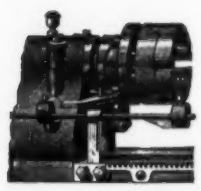

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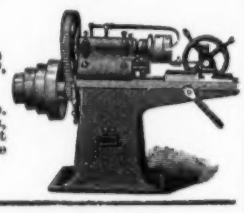

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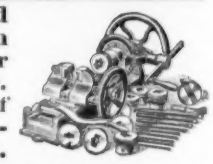

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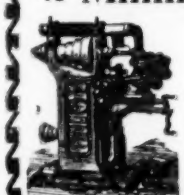

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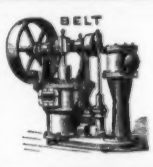

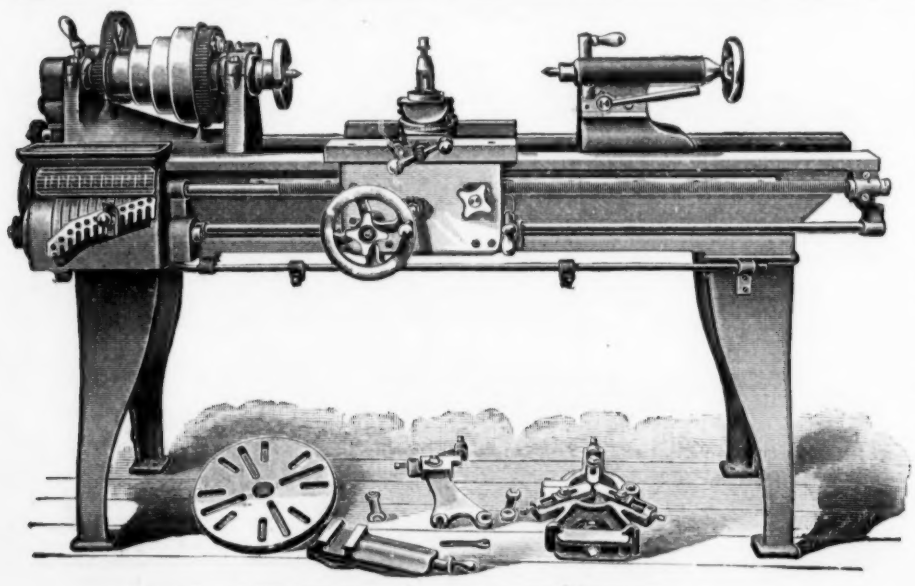

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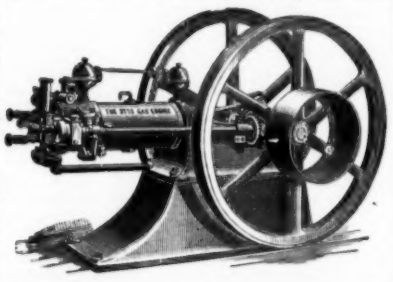

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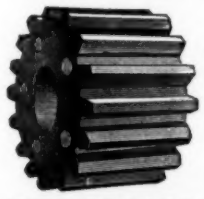

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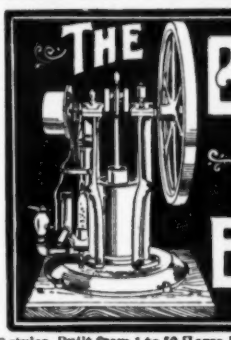

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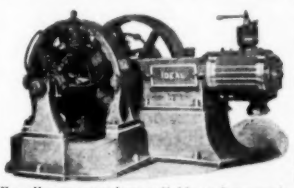

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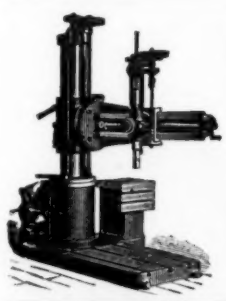

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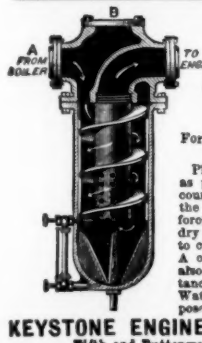

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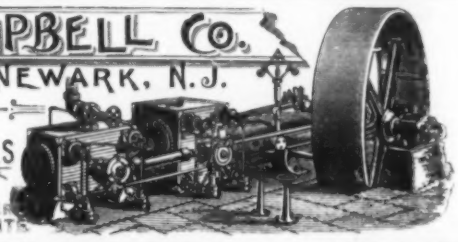

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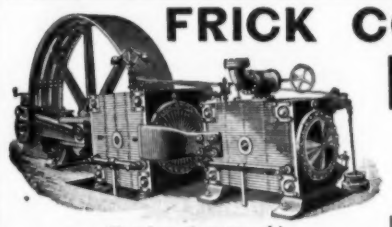

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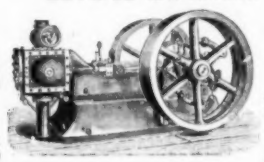

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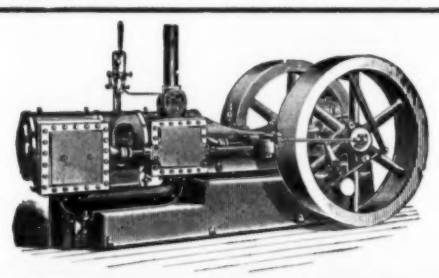

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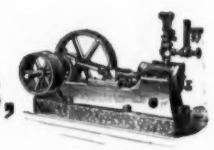

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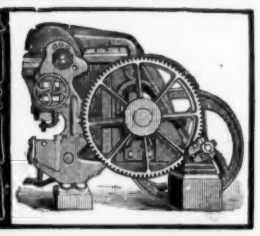

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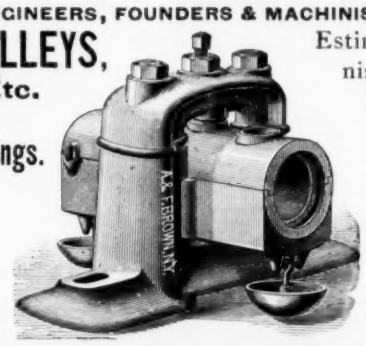

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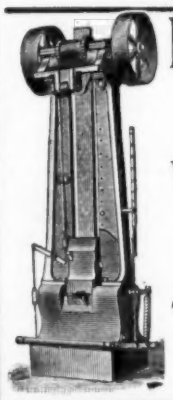

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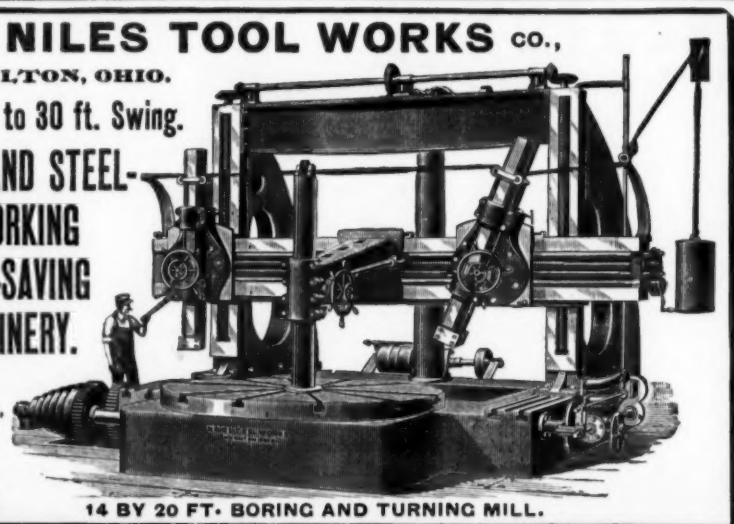

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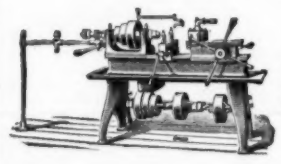

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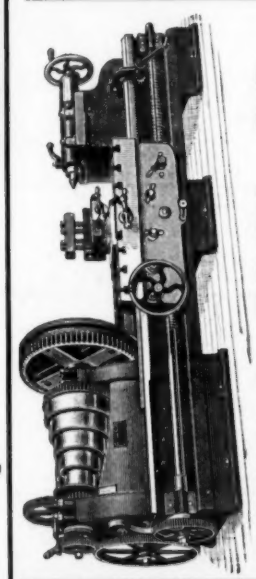

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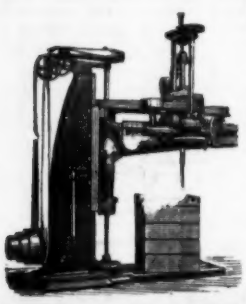

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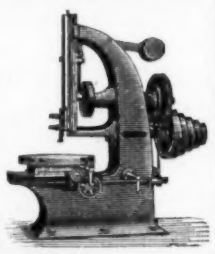

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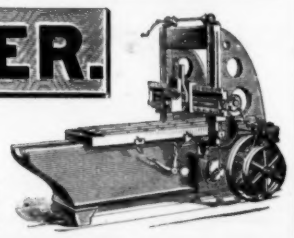

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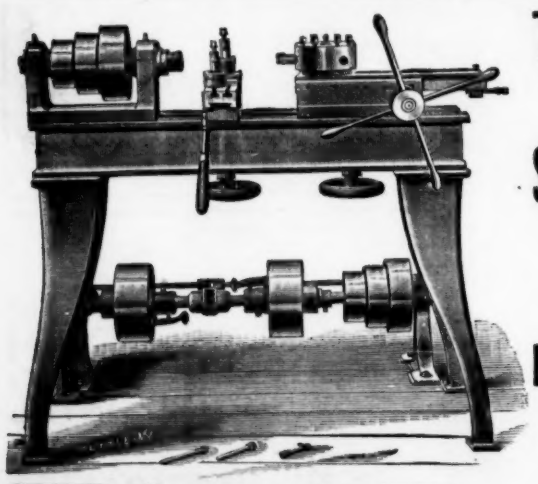

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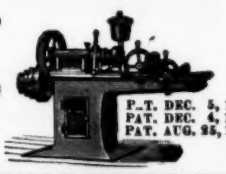

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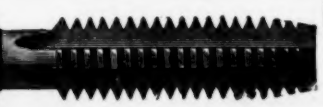

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